JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

Good Intentions and Preliminary Action.

THERE cannot be anything but disappointment on the part of the Council of the Institution of Gas Engineers that they have to meet the members again with a report which shows so little effective and tangible result from their executive work during twelve months. For this the Council are to be more commiserated with than blamed. Events and higher authority have gone against them. The only things they have really accomplished have been, in the first place, to bring about, on the initiative of Mr. A. F. Browne, a needed reform in the examinations in "Gas Manufacture" under the Board of Technology of the City and Guilds of London Institute, by a revision of the lines of the examinations and by creating a very desirable separate examination in connection with distribution, and, in the second place, to obtain, in response to a special appeal, the comparatively poor sum of £617 (including promised contributions amounting to £50) for the special purposes fund. We look in vain for any other result from the executive work. At the same time, the Council have been anything but idle. Though the harvest is small, the work of preparation has been proceeding as fast as circumstances would allow; and as a set-off to the want of realization, we must take the preliminary work, and weigh it with the most sanguine anticipations that it will produce much of real worth in the future. This we are able to do when we consider the men who have undertaken the conduct of the work to which hand has during the year been put, though the funds at the disposal of the Council are not of the substantial character that could be desired, and that it was expected would have been provided by an industry of such affluence as that of gas, and an industry whose future progress is so dependent upon the discoveries of thorough, skilled, and scientific research. The balance of the special purposes fund was only £872 at the end of last year; and there is the £50 of promised contributions. The balance, however, embraces the £399 donation "Balance of Inter-"national Gas Exhibition Fund," which is a windfall that is not likely to be repeated for many a long day; so that, unless further succour to the fund is shortly forthcoming, the Council cannot possibly be long, in view of the expenditure to which they are committed, before they are again financially aground for research work. The hope, however, is that the results of the investigations now in progress will prove to doubting gas administrators the capacity, willingness, influence, and opportunities of the Council to direct investigation to an end of common usefulness, and that substantial and constant support will then be forthcoming.

The Council have entered upon two roads of investigation; and the choice is good—the one being "The Various "Methods of Carbonization;" and the other "The Econo-"mical Application of Gas for Heating Purposes." Independent and individual research into carbonization, and the multiplication of processes, have introduced of late years many problems and a shoal of inharmonious ideas, that must have brought upon them definite and purposeful work to solve and to separate what is correct from misconception. In regard to the use of gas for heating purposes, there is excellent work to be done to produce further economy. A high pitch of economy has been attained in gas lighting; and while in gas heating, possibly owing to a large extent to the stereotyping of means, there has been improvement in this direction, the pace has been but slow. Of course, it cannot be expected that anything like a comparable economy with that achieved in the use of gas for lighting purposes can be realized in connection with gas heating. But whatever can be done should be done. The collateral advantages of heating by gas, when compared with the use of raw fuel, do not appeal to the consumer with the same force as a low account for the service rendered; and therefore in taking up this question of the economical application of gas for heating, the Institution are doing a real good for the industry, which it may be hoped will bring about a large development of the heating branch of business. In this investigation the co-operation of Professors Smithells, Bone, and Cohen has been sought; and in so seeking, the Council have made a move which will commend itself to all who have subscribed to this investigation work. The step will also be applauded by which the Council have, as it were, retained the facilities and the inestimable supervision afforded by the University of Leeds to assist them in their investigations, by the establishment of an Institution Fellowship in Gaseous Fuel under Professor Bone, of the value of £100 a year, bearing in addition the incidental expenses of investigation. By this—as we fully believe the investigation into the economical application of gas for heating purposes will demonstrate—thoroughness will be assured. It is a pleasure to see the Institution made the channel through which the bonds between science and practice in the gas industry are being tightened, and of which there is further evidence in the nomination this year of Professors Harold B. Dixon and Arthur Smithells as Honorary Members.

Among other announcements made in the report is that Messrs. Charles Carpenter and James W. Helps have been appointed to represent the British gas industry at the second Conference of the International Committee on Photometry at Zurich in July; and more efficient representatives could not have been chosen. It is four years since the International Committee first met; but the results of that meeting have been, we are sorry to say, of negative rather than positive character. The meeting produced much interesting information; but we fail to find in practice that the science of photometry reaped any material benefit from it. There has been, "necessity being the mother of invention," more substantial advance at home, and about that advance no one better than Mr. Carpenter can give information. For this reason, and because, in all international effort in which the gas industry is concerned, we should be loth to see Great Britain left out in the cold, the Council have done well in obtaining the services of two such delegates for the second Conference as Messrs. Carpenter and Helps.

There are three or four matters to which the Council have devoted consideration, or have taken action upon, which have, through no fault of their own, proved abortive—finally or temporarily. The steps taken towards securing the amendment of the Conferences Act, to legalize the payment of expenses incurred by members in the service of local authorities, have so far been fruitless. A serious attack was made by the Council upon the important question of the amendment of the Gas-Works Clauses Act; but the idea of effecting any good in this direction has been regretfully abandoned. Such amendment as could have been proposed would only—the Parliamentary Committee say, and the Council have accepted their declaration—have consisted of model clauses. But such amendment so far as it goes would have been valuable to promoters of Gas Bills; and we fear there is more importance to be attached to the passage of the report "having ascertained also the views "likely to be taken by the Board of Trade on the subject," than appears on the surface. Perhaps it would not be politic on the part of the Council to disclose the nature of those views; but without knowing what they are there is little comfort for, and the Council are asking for a very complete confidence in their judgment of, those who have urged upon them the necessity for revision of the General Acts. With regard to the movement made by the London County Council to obtain the amendment of the Sales of Gas Act, the Council have, after conference with meter manufacturers (arranged through the Society of British Gas Industries), endeavoured to ensure the representations of the gas industry being considered on any amendments that may be proposed; but the Board of Trade, with characteristic caution, have not gone farther than a promise, "in the

"event of any such amendment being determined upon," to bear in mind the Council's communication.

Again, the action of the Society of British Gas Industries in inviting the Council of the Institution to associate with them in drafting not a compulsory, but an optional, set of standard clauses for contracts has resulted in a rejection of the idea by the Council. The reason given is not very remarkable for strength or independence of action. The Council find that "it is not the custom of the Council of the "Institution of Civil Engineers to suggest to its members "any particular form of contract clause;" and because the Council of the Civils, representing the science and art of engineering as a whole, and not any single commercial industry in which engineering has part, has not done anything in this way, then—because of that!—the Council of the Institution of Gas Engineers also refrain from such a simple work as drafting, as a suggestion only, a set of model general conditions for contracts. The excuse for inaction is a lame one; and one cannot help wondering, if precedent and the fruit of precedent were wanted, why the Council did not (we do not gather they did from the report) go to a source for guidance—the Institution of Electrical Engineers—where a set of model contract conditions has been framed and where experience is that they have been largely and voluntarily accepted, and not to a source where nothing of the kind has been done. The Council of the Institution of Civil Engineers have done many things that the Council of the Institution of Gas Engineers have not done; and the latter have done many things that the former have not done. For instance, it is the "custom" of the Institution of Civil Engineers to admit to membership——perhaps, however, we had better not refer to this matter. But for the Council of the Institution of Gas Engineers to excuse action in one matter because it is not the "custom" of the Civils, is, to say the least, rather unfortunate.

However, taken as a whole, the report contains many good intentions and much preliminary action; and so we may look hopefully for something more solid in future accounts of the results of the stewardship of the Council.

The Woodall-Duckham Process of Continuous Carbonization at Bournemouth.

THE subject of greatest technical interest that we have to offer our readers this week is contained in the special article on the Woodall-Duckham vertical retort system at Bournemouth, which the members of the Southern District Association of Gas Engineers and Managers were allowed to inspect on their visit to their President (Mr. Harold W. Woodall) last Thursday. Messrs. Woodall and Duckham have been anything but communicative as to their work in this connection; and one cannot but admire their steadfastness, confidence, and earnestness until they had arrived at a "something attempted, something done" stage in their working. A definite point has been reached, and that is the demonstration of the practicability of continuous carbonization with the combination of devices and methods that the workers have skilfully and perseveringly effected, which reduces labour to a minimum, requires a moderate amount of motive power, brings relief in carbonizing operations from the nuisances of smoke, dirt, and noise, and produces no naphthalene and stopped-pipe troubles. That is one side of the picture; the results are the other. From the results realized from the present settings at Bournemouth, Messrs. Woodall and Duckham have lifted the veil. But these are not yet the results—attractive as they are—that are submitted for critical examination. They are only submitted as it were by the way. Certain minor changes are to be made, by which the quantity of coal that will be passed through each retort per twenty-four hours will be about 3 tons instead of 2 tons, and by which the values of the figures now presented, it is expected, will be further improved. It will probably be to the Linacre works of the Liverpool Gas Company, and to the Nine Elms Gas-Works of the Gaslight and Coke Company, that we shall have to look for the next chapter in the story of development.

Meanwhile, though the daily figures as to make per ton of coal carbonized at Bournemouth and the returns as to illuminating power, are somewhat erratic (the corrective is, we believe, being applied), they are promising in view of the trend of present-day requirements. But though somewhat erratic, we have an average make of gas in that period of over 13,000 cubic feet per ton of 14¼-candle power from ordinary working, and not from a special trial run, over 22 days, and approaching 14,000 feet of nearly 15-candle power on certain of the days. The returns suggest that we are on the high road to meeting the requirements of the times. True, the gas is tested by the Metropolitan No. 2 burner; the carbonic acid, however, is not eliminated. But this the gas testings under the new order of things in London have shown us, that the South Metropolitan Gas Company are not reaping all the advantage that 14-candle gas and the "Metropolitan" No. 2 test-burner should give them, from the simple fact that, supplying coal gas only, the established methods of production have not afforded that increased output, and consequent diminution of illuminating power, that would satisfy statutory and practical requirements. The figures presented in our article are not up to points with which Messrs. Woodall and Duckham are contented. Nevertheless, they are such that, combining them with the successful production of other advantages in working, the inventors of this continuous carbonizing system have fully earned the unstinted congratulations of their fellow professionals, and thanks for their invaluable contribution to technical knowledge. They have worked with an irrepressible spirit, in spite of difficulties; and we hope not only that their names will appear (as they must do) in the pages of the history of gas manufacture as ardent workers in the cause of advance, but that a full measure of reward is within their reach.

Tar Fog and Purification.

Two papers dealing with these subjects were presented to the meeting of the Manchester District Institution of Gas Engineers on Saturday. The estimation of tar fog and its separation from gases were discussed by Messrs. R. H. Clayton and F. W. Skirrow in admirable fashion, and particularly in relation to purification, on which subject Mr. G. H. Niven, of Cleckheaton, had prepared a straightforward narrative of his experiences. The question of the removal of tar fog from gas has become a serious one for the large and increasing number of gas-works which do not use lime as a purifying material, since the separation of tar and its accumulation on the particles of oxide of iron renders the oxide less and less active with each successive revivification, till ultimately it is discarded on that account long before its innate capacity as a purifying agent is exhausted. Moreover, the spent oxide which is contaminated to a considerable extent with tarry matter cannot command the same price for its contained sulphur as equally rich spent oxide which is relatively free from tar. Hence the question of the separation of tar fog from gas before it enters the purifiers is a vital one, and that of the estimation of tar fog in gas is closely associated with it.

As in many analogous instances, the analytical work proper of this estimation is not difficult; but it is frequently rendered futile by faulty sampling. Messrs. Clayton and Skirrow point out that bad sampling has been responsible for the failure of many of the investigations on the naphthalene difficulty conducted by Messrs. A. H. White and J. M. Barnes for the Michigan Gas Association. They lay down a set of rules for the proper sampling of gas for the determination of tar fog, based on those of the late Dr. Hurter for the estimation of suspended particles in flowing gas. Briefly these rules require that the sample should be drawn at greater velocity than the rate of flow of the gas in the main, through an orifice in a sampling tube which contains filtering material, and is so placed within the main that the orifice faces the stream of gas at a distance of one-third the diameter of the main from the nearest side. The sample is thus taken, without any baffling effects, at the temperature of the gas stream, from a point where its velocity is the average of the velocity of the gas in the main. Given proper sampling, the mode of estimation of the tar is of relatively small importance since comparative results only will generally suffice in any particular series of investigations. Messrs. Clayton and Skirrow, for instance, only estimate those constituents of the tar which are soluble in carbon disulphide, and are not volatilized with it. Thus the free carbon and benzol of the tar must be added to the results they give, in order to arrive at the approximate amounts of total tar in the gas. Obviously, therefore, their results for tar in coal gas are not strictly comparable with their results for tar in carburetted water gas, owing to the different proportions of fixed carbon and highly volatile constituents in the two tars. But nevertheless the various figures for either

type of gas are comparable among themselves, and for most practical purposes it is unnecessary to carry the comparison any farther.

The results achieved by different types of apparatus in the extraction of tar from coal gas, as determined by the tests of Messrs. Clayton and Skirrow, indicate that the Pelouze and Audouin extractor is far more efficient than the Livesey washer, and that, provided the differential pressure of the apparatus exceeds 2 inches, the amount of tar left in the gas is quite small, and is independent of the amount in the gas, when it enters the extractor. Whether the extraction of the tar fog involves the simultaneous removal of the bulk of the naphthalene from the gas is a question the authors have so far left untouched. Their observation that the Pelouze and Audouin extractor is unsatisfactory for the abstraction of the tarry matter from carburetted water gas throws an interesting side-light, however, on the limitations of the machine, and its selective action in regard to different constituents of tars. Incidentally, it may here be remarked that the authors assume that the tarry matter in carburetted water gas is everywhere a source of considerable trouble in the purifiers; and they do not appear to have considered that much depends upon the water-gas plant being suitably proportioned and properly manipulated, and something upon the description and amount of oil gasified in it. Nevertheless any apparatus which would tend to reduce the amount of tarry matter retained in the purifying material would be a welcome adjunct to water-gas plant; and the suggestion thrown out by Messrs. Clayton and Skirrow, that a centrifugal fan would be serviceable in this direction, deserves very serious attention. We do not, however, dare to assume, with them, that the results of the application of the centrifugal fan to the cleansing of producer gas justify the expectation of equally good results when the fan is employed to extract tar from water gas. The analogy between the two problems is not close. In regard to the exhaustion of oxide in water-gas purifiers, account must be taken of the proportion of sulphuretted hydrogen in the crude gas, and the figure of 0·4 per cent., or (say) 250 grains of sulphur per 100 cubic feet, of which the authors speak, is probably appreciably higher than the normal.

Mr. Niven, in his paper, also emphasizes the importance of the extraction of tarry vesicles from coal gas before it enters the scrubbers and purifiers. He favours the use of exhaust steam in the tar-extractor, and fully believes that the resultant warming of the tar enables it to remove a maximum amount of naphthalene from the gas. But until his favourable experience is confirmed at a number of gas-works, it would be unduly optimistic to assume that he has found the solution of the naphthalene problem, which has hitherto eluded numberless investigators.

Common Sense at Nottingham.

THERE has now been enough inquiry and reporting upon the troubles in connection with the Nottingham Corporation Gas Department, that have in the past been grossly inflated and turned, by men whom two reports indirectly convict of having been unable to trace to their proper sources the real causes, to the evil use of maligning the competency of the Engineer (Mr. J. H. Brown). The report of the Gas Public Inquiry Committee which was appointed four months ago was issued to the City Council on Friday; and the report completely clears Mr. Brown's professional ability from the aspersions levelled against it, just as did the report of the Special Investigation Committee last year, though in the case of the latter the relief given to the Engineer from his accusers and persecutors was wrapped up in a sentence of such moderation that it almost seemed that the act of doing justice to an official was distasteful. "Your Committee find that the charges made against the "Gas Engineer have not been proved," said that Committee. That was the first clause of the report; and Alderman Jelley, the present Chairman of the Gas Committee, in the debate on the report in October, said he "hoped the "Committee would withdraw that clause, and then there "might be some sense in what followed." The last remark in the report of the Public Inquiry Committee that will be before the Council next Monday is: "No charges were made "against the Engineer; and the inquiry showed no ground "for doubting his capacity to manage the undertaking." The Committee are to be thanked for having unbidden made such a declaration, and for doing the just thing. Most men after this pronouncement, and after exhibiting such bitterness and open antagonism to the Engineer as Alderman Jelley has done in his speeches, would find continued occupancy of the chair or a position upon the Gas Committee somewhat thorny and uncomfortable. We do not envy him the bitter pill he is called upon to swallow; and how dignified or otherwise he will do this remains to be seen. Honour should suggest that the least he can do is to make Mr. Brown public reparation, and admit his mistake.

The absurdity of the whole case that was piled up at the door of the Engineer—an absurdity that was seen by every qualified technical judge long since—has now been fully disclosed by a Committee of common-sense men. The case has been shattered as completely as a child's finger can shatter a house built of cards; and the tables have been turned upon Mr. Brown's accusers. The Committee cannot discover from the returns of the percentage of complaints any justification for the charges made; and as a matter of fact they find that, had the Gas Committee's original policy, adopted on the advice of the Engineer, of arranging for the care and inspection of consumers' burners and fittings concurrently with the reduction of candle power, been carried into effect, it would greatly have reduced the number of complaints made in 1904 and the first eight months of 1905. What have the old Gas Committee to say to this? The evidence goes to show that the reduction of illuminating power found out the inefficiency of fittings and burners; and that the alterations made remedied the defects. The nonsense that has been uttered in the Council about the diluting effects of the blue water gas sent out with the coal gas is brought into relief in the report by the quoted percentages of that gas that have been distributed in admixture with the other gas. The difficulties regarding pressures are shown to be due to the arrangement of the distribution system prior to the advent in Nottingham of Mr. Brown; and these have been remedied by sectionizing according to levels. It is also shown how Mr. Brown was handicapped, by the system that was also established before his appointment, in discovering certain malpractices at the Eastcroft works, which had the admitted effect of vitiating the gas. In short, there is more traceable to the years preceding 1902, when Mr. Brown was appointed, than short-sightedness in a small administrative circle in Nottingham had, before this public inquiry, been able to detect. There has been improvement since 1902; but the way to loss is always easier than to recovery. We cannot agree with the Committee as to their conclusion that it is doubtful whether there would be any appreciable falling off in the use of stoves if customers were not able to hire them from the Corporation, but had to make provision for themselves. There are many matters in the report that invite fuller discussion than opportunity permits on this occasion.

London Gas Companies and the Price of Coal.

In this month's "Investor's Chronicle" a very misleading statement appears in reference to the effect of the increased cost of coal on the London Gas Companies. It is as follows: "Gas stocks have been adversely affected by the increased cost of coal in recently-arranged contracts. For the London Companies, fuel will apparently entail an expenditure of an additional £2,500,000 this year, less the increased amount that will be obtained for residuals. This means a higher charge for gas and reduced dividends." This is, of course, quite incorrect, as the three London Gas Companies—taking the increased price of coal at the rate of 3s. per ton—will not have to pay more than about £460,000, to meet the increased cost of coal; and this will most probably be reduced to about one-half owing to higher prices being realized from the sales of coke. It may be that the enormous amount mentioned above is a printer's error; but in any case it will very probably suffice to frighten holders of gas stocks out of safe investments, and for this reason attention should be called to its inaccuracy. As to the higher charges for gas, it is not at all certain that the Gaslight and Coke Company and the Commercial Company will be forced to raise their charges for gas—both Companies being in a fairly strong financial position and both having of late shown improvement in half-yearly results, especially with regard to increases in gas sales. The South Metropolitan Company are not so well placed; but as Sir George Livesey mentioned in his speech to the shareholders at the half-yearly meeting in February, an increase of 2d. per 1000 cubic feet in the charge for gas will only

mean a reduction of the trifling amount of 8d. per cent. in the rate of dividend. Therefore the future reductions in the rate of dividend are not so apparent as our financial contemporary has erroneously pointed out.

The Social Side in Dublin.

Last week, the members of the Institution of Gas Engineers received the full programme for the meeting a fortnight hence in Dublin; and they will, we venture to think, be highly gratified with the provision made. The technical side of the meeting has been already editorially commented upon. There will be hearty welcome to the city on the part of the civic authorities and the Chairman (Alderman W. F. Cotton, D.L., J.P.) and Directors of the Alliance and Dublin Consumers' Gas Company, the latter of whom will entertain the members (who apply for cards of invitation according to the circulars received) on the second day of the meeting. Alderman Cotton has, with his sons, taken an energetic interest in the visit of the Institution; and apart from the hospitality of his Board, he will, as Chairman of the Works, Lighting, and Machinery Committee of the Irish International Exhibition, personally conduct the specially-arranged inspection by the Institution, on the Tuesday evening, of the exhibits in the Gas Pavilion. It is also announced that the Company's Brunswick Street works and their Grafton Street show-rooms will be thrown open to the inspection of the members. There will also be a reception by the President and Mrs. Charles Hunt on Thursday evening at the Mansion House; and, following the reception, there will be dancing and a concert. The courtesy of the Right Hon. the Lord Mayor, in lending the Mansion House for the occasion, will be much appreciated. Arrangements have been made for three attractive excursions—one embracing the week-end at Killarney—after the meeting.

A Satisfactory Year at Birmingham.

Gas matters have been occupying a considerable amount of attention in Birmingham during the past week; the report of the Gas Committee dealing with the results for the year to March 31 having been presented to the Council. The progress the Committee were able to indicate cannot be regarded as otherwise than satisfactory; the increase in the quantity of gas sold and used on the works being 164¾ million cubic feet, or about 2½ per cent. A sign of the times is the fact that during the year new accounts were opened with prepayment consumers at the rate of over 500 per month. A gross profit of close upon £180,000 has been secured, while the average price charged for gas has been the lowest in any year since the Corporation acquired the property in 1875—that is to say, 2s. 0½d. per 1000 feet. This gross profit looks large; but it was pointed out by Alderman Sir Hallewell Rogers that it represented a smaller charge per 1000 cubic feet of gas sold than was required and exacted by ninety-six out of every hundred of the gas undertakings in Great Britain. Under these circumstances, he urged that the consumers both within and outside the city—being well served by the Corporation—should not become the victims of any feeling of envy if, by good management, the Corporation, after providing interest and sinking fund charges, were able to declare such a large surplus as £57,563, which was the largest sum contributed by the department in aid of the rates of any one year. This, however, was not the view taken by Mr. Arter, who characterized the sum mentioned as an "excessive profit," the price of gas from which it was derived "falling most harshly and unfairly on manufacturers, shopkeepers, and large consumers," who were entitled to consideration. Mr. Arter did not allow his protest to end in the Council Chamber; for in a subsequent interview with a local newspaper representative, he set forth at considerable length his arguments in favour of a reduction in the price of gas. Summed up, his contention is that the most logical and fair policy is to supply gas on a scale of charges graduated according to the consumption; and he claims that, "having built up a sound concern, the consumers are now entitled to a substantial reduction in price—amounting to 10 per cent. all round." The interview (which is noticed elsewhere) certainly presents a strong case in favour of the cheapest possible supply of gas. One other matter arising out of the Gas Committee's report was a proposition to raise the salary of Mr. G. Hampton Barber, the Secretary of the department, from £1200 to £1400 a year. This gave rise to considerable discussion; but in the end the resolution was carried by a good majority.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 687.)

THE Stock Exchange has had an agitated week, and apparently is not yet quite out of the wood. The slightly brighter ray which peeped through the gloom before the close of the previous week, faded away on Monday morning. A large parcel of gold slipped away to the Continent, money stiffened, and a failure of some importance was announced. This was bad enough for a beginning. Tuesday opened very nervously, and the settlement of the fortnightly account was a thing of dread. Prices shrank accordingly; and Consols were several times done at 84⅛, getting very near to a 3 per cent. price. But the reported arrangement of a prospective difficulty brought a little relief in the afternoon. This made things better on Wednesday; and markets breathed more freely. On Thursday, in spite of one failure and the knowledge that some lame speculative dogs had to be helped over their stiles, some little improvement was effected by the aid of buyers for investment attracted by the "slaughter-house prices." But on Friday, the wind was blowing again from the old quarter; and the markets were all aback. The settlement gave rise to fresh anxiety, and the problem of tiding over difficulties was feared to be insoluble. This continued to the close; and some markets were specially dull on forced realizations. A particularly sad feature of the week was that the ill-fortune of one member had a tragic ending on Saturday night. In the Money Market, there was a steady demand for the Stock Exchange and the month's end requirements, and rates steadily stiffened. The discount rates, however, ruled light, though inclined to harden a little at the end. Business in the Gas Market was on a very moderate scale, even on the busiest day of the week (which was Friday), and some days were very slack indeed. There were hardly any changes of quotation beyond the usual *ex div.* variations, and they were irregular. In Gaslight and Coke issues, there were dealings every day on a limited scale in the ordinary at the old figures; the limits of prices marked being 92¼ to 93¼. The secured issues were not quite neglected; the maximum changing hands at 87½ and 88½, the preference at 102½ and 103½, and the debenture at 83¾ and 84¼. A small amount was done in South Metropolitan at close prices, which kept within the range of 122½ and 123½; and the debenture marked 83¾. The only operation in Commercials was one in the 4 per cent. at 109. The 3½ per cent. was put down a point. In the Suburban and Provincial group, Bournemouth "B" changed hands at 161/16, Brentford old at 249 (with a rise of 2 in the quotation), Tottenham "B" at from 101 to 102¼, and West Ham at 103½ and 104. In the Continental Companies, Imperial was flat, and had a fall of 4; transactions ranging from 170½ down to 166. Union was done at 117, and ditto preference at 141. European notify an improved dividend; but no business was done. Cagliari marked 26¼. Among the undertakings of the remoter world, Buenos Ayres marked 11¼ and 11⅜, ditto debenture 96, Primitiva 6 5/32 to 6 1/16, ditto preference 5 1/16 to 5 1/8, River Plate 13 1/16 to 13⅛, San Paulo 12⅝ and 12¾, and Melbourne 5 per cent. 100½.

ELECTRIC LIGHTING MEMORANDA.

Darkening our Light—How to Make Electricity appear Cheaper than Gas—Workhouse Extravagance Extraordinary—The Consulting Engineer Defends Himself—Politics and Electricity Supply.

"LIGHTEN our darkness." Gas has responded; and electricians have set themselves the quixotic task of attempting to prove that the prayer was a mistake, and that it is really less light the consumer requires. Following up this line of reasoning, somehow or other electricity, on a reduced illumination, but maintaining that for gas, comes out cheaper than its competitor. Mr. Lancelot Wild is one of the gentlemen who deal with electric illumination sufficiency, and the relative costs of gas and electricity; and he has again permitted himself to ramble into some remarkable calculations on these subjects in the columns of the "Electrical Times." It is really little use for this gentleman to deal in fiction as he does over this matter, when most gas undertakings in the country with electricity concerns in competition with them can point to many consumers who have returned to gas solely on account of the greater expense of electricity. The administrators of those electricity undertakings surely do not believe in Mr. Wild, or they would take counsel with him, and allow their engineers to sit at his feet and learn. But perhaps those administrators and their engineers know, as we do, that Mr. Wild's laboratory tests, refinements, and specifications on behalf of electricity will not work out in ordinary practice. To deal completely with all Mr. Wild's arguments and figures would necessitate quite a substantial encroachment upon our space and leisure. Mr. Wild has apparently plenty of the latter. However, his latest essay appears in the "Electrical Times," and an extraordinary performance it is. But the end of it all is that he finds that, taking a £40 a year house, for lighting alone gas will cost with "C" incandescent burners 6·25d. per evening, and with inverted burners 4·65d., which figures compare with 6·75d. for carbon filament electric lamps, 6d. for tantalum lamps, and 4·05d. for osram lamps. Therefore, taking gas at 3s. per 1000 cubic feet,

and the 6·25d. for gas for incandescent gas-burners, Mr. Wild makes out that in a £40 a year house about 170 cubic feet of gas would be used for lighting in an evening! If only this were actually so, to say nothing of gas used for cooking and heating, what an exceptionally rosy time our gas undertakings would now be having! That is one of the things that do not work out in practice.

Mr. Wild has taken in his workings "the mean conical candle power," the candle power at an angle of 60° for a "C" burner as 21-candle power, the consumption of gas in that burner as 5·17 cubic feet per hour, we think too he leaves the burners to their own devices for 500 hours, and takes the average of his illuminating power tests under such conditions; and so he wanders on, in his own sweet fashion, through a wonderfully conceived maze, until he arrives at the figure already quoted of 6·25d. for gas used in incandescent "C" burners, together with those for other systems of lighting, for the illumination for one evening of a £40 a year house. His figures for electricity are whittled down to what they are by a process of economy that—so far as several opportunities have enabled us to judge—also does not obtain in practice. For instance, Mr. Wild allows a "C" incandescent gas-burner for lighting a sitting-room; but where incandescent carbon filament electric lamps are used, he permits the darkness to be minimized by the use of three 8-candle power lamps. But he has the courtesy to allow the maid-of-all-work in the £40 a year house the same number of 8-candle power lamps as her master and mistress and the whole family are granted in a sitting-room. It is indeed, as Mr. Wild says, very difficult in every case to determine what is a sufficiency of light; and, as people do not want their rooms illuminated like penitentiaries after daylight fails, but in a light and life-giving fashion, they are not likely to adopt Mr. Wild, in this matter, with his parsimonious illumination notions, as a guide, philosopher, and friend. Of course, cheapness can always be arrived at by reducing use. If a light of 24, 16, and 8 candle power is sufficient for the various apartments of a house, we can do better than Mr. Wild's electric lamps on a total consumption of 25 cubic feet of gas in an evening, taking his schedule of hours of burning. However, in the opening lines of the article, Mr. Wild does admit that "on a basis of equality of horizontal candle power, and neglecting the effect of bye-passes, and the economy obtainable by switching off electric light when not required, the claim of gas to be but one-tenth as costly as the electric light is not so far from the truth." But, says Mr. Wild, this is not discovered by an inspection of the consumers' bills. If the consumers' bills that Mr. Wild has acquaintance with had shown also the comparative illumination obtained, he would have no occasion to worry his head about mean conical candle powers, cost of candle power (at an angle of 60°) per hour, and fanciful specifications for house lighting, to show which illuminant is the cheaper light for light. "Switching on and off" can be obtained with gas; but as frequently as not that facility tends, with electricity as well as gas, as much to waste as to economy.

There have been several scandals lately in connection with local government which all point to an insufficiency of control. The details of those in which elected representatives have criminally violated the trust reposed in them by the ratepayers have received wide publicity; therefore we have no intention of alluding to them here. The story of the extravagance at the Hammersmith Palace—called by some humorists, the workhouse—is another matter. It is in the electric lighting of this palatial building that we, who are fortunately not ratepayers, are interested, and that interest has already been divulged in a former issue of the "JOURNAL." Since then, there has been some further evidence from electricians (at the inquiry being held by the Local Government Board) upon the subject, which evidence confirms what has been said previously as to the abandonment to luxury and excess of those responsible for the scheme, and also emphasizes the need, in the interests of ratepayers, for a more perfect system of local administration, and control over that administration. Here is a case, proved up to the hilt, where the money has been wastefully spent, and gone beyond reclaim; and the burden of the principal and annual expense falls directly upon the ratepayers, who have had no protection whatever afforded them against incompetent and easily persuaded amateurs. It is as we suspected—this Hammersmith palace is being supplied by electricity from the Borough Council's electricity station; and we guarantee that the relationship between Council and Guardians is not a distant one. If electricity was the best system of lighting to be adopted in the building, Mr. Chambers, an electrician called in by the Local Government Board, has stated that off-hand he should think the obvious course for the Guardians would have been to have put down plant and to have themselves generated the whole of the current they required for the building. This "offhand" opinion was supported rather more emphatically by Mr. Horace Boot, who calculates that the Guardians could have saved £450 a year by installing their own plant at an additional cost of £3200.

Both Mr. Chambers and Mr. Boot aver that the duplication of the electric wiring and the fitting up generally has been carried to extraordinary lengths, and everything has been done on too elaborate a scale. And not only has the work been excessive in measure, but the prices paid for the fittings generally have been considerably more than their purpose warranted. A large number of the lamps outside the building are never used; and Mr. Boot says there is about 30 per cent. too much light in the building. The published details ought to make millionaires quite green with envy. But, after all the expense that has been incurred, there are defects in the installation. Flexible pendants are used in the infirmary; and Mr. Chambers has told the inspector that these are dangerous and objectionable. It is not the first time this has been heard. Cables have also been laid through a subway in which the temperature is very high; and the rubber insulation under such conditions deteriorates very rapidly. The wonderful facility for switching electric lamps on and off, which in theory promotes economy, but in practice as frequently promotes extravagance, does so in this case. Mr. Chambers was asked whether 50 per cent. of the lamps would not give a reasonable amount of illumination. His reply was: "Certainly in some rooms. When I was at the workhouse both switches were on, and no effort was made to carry out this beautifully economic system." Neither Mr. Chambers nor Mr. Boot could justify what has been done; neither of them, unless he wanted to establish a reputation for extravagance, would have done anything of the same kind. But, after all, the electric lighting installation is only part of a scheme of great lavishness. One expense has led to another; and, as Mr. Boot clearly puts it: "It is a case where the Guardians had plenty of money to deal with, and they dealt with it." When there is great rejoicing over the fact that someone has found out—before the work is done—that it is cheaper to light workhouses and other public institutions by electricity than by incandescent gas lighting, they may be asked to calm themselves by reading the story of the Hammersmith Workhouse, or of the Cardiff Mental Hospital, to which allusion was made in the "Memoranda" on April 2.

Since, however, the foregoing evidence was given, the Consulting Electrical Engineer (Mr. James Enright) has been on the scene, and has defended himself, given away the Guardians for doing things that he should have advised them not to do, and has rather injured the cause of electricity by showing that, after all the expense on the electric lighting of the workhouse, there are complaints of deficient lighting. He stated that the master had informed him that the lighting of the wards was very poor, and that of the officers' quarters scanty. Even the clergyman who conducts the services at the workhouse has written to say that he finds great difficulty in seeing to read the lessons. This is either a reflection on electric lighting, or on Mr. Enright's capacity for making proper provision. It is also a direct contradiction of the evidence as to excess lighting previously given. However, Mr. Enright thinks that he has made liberal and not excessive provision; and he is naturally of opinion that the work has been cheaply carried out. It is interesting to observe that he defends the double-circuit system installed, on the ground that the workhouse inmates should not be put to any inconvenience in the event of a failure of the light. Residents in Park Lane and other aristocratic localities where electricity is used for lighting should note this. But, whatever Mr. Enright says, facts remain facts.

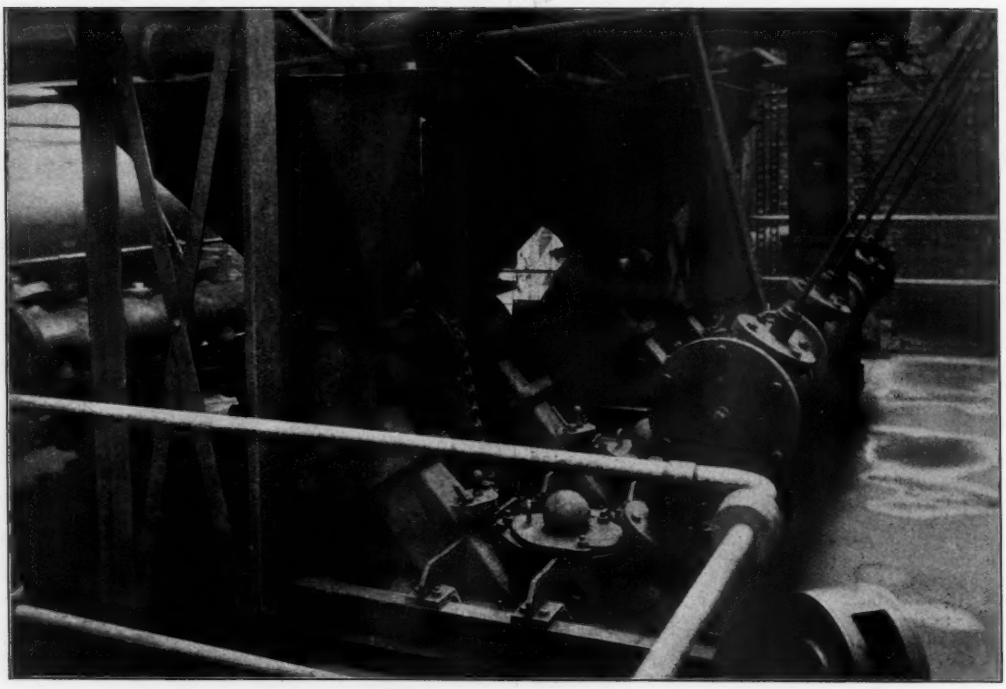
As suggested last week, the whole question of the electricity supply of London is being dealt with in the present Parliament as a party question. There is no doubt about this, after the resumed debate on the second reading of the London County Council Bill last week. It was very amusing to hear men of Progressive colour, knowing nothing whatever about the technical aspects of the question, talking about the present County Council producing, by mismanagement and bungling, the ruin of the electric lighting of London, and urging that the Committee to which the Bill was referred should consider all sorts of things. The old Council were doing their level-best to ruin the whole of London; and the existing Council are not of a mind to follow in their footsteps. The Bill was, after a good deal of small talk, referred to a Hybrid Committee, but, on the suggestion of Mr. Lloyd-George, with this instruction—"That if any power be conferred upon the London County Council to transfer or lease to any company, local authority, body, or person any of the powers, duties, or liabilities entrusted to it by this Bill, the conditions upon which such power shall be exercised shall be embodied either in this or a subsequent Bill."

Midland Association Excursion.

A carefully planned excursion for members of the Midland Association and their lady friends, was hopelessly spoiled last Thursday by rain, which fell more or less heavily, but persistently, from start to finish. It had been arranged by the President (Mr. Hubert Pooley, of Stafford) and the Hon. Secretary (Mr. C. Meiklejohn, of Rugby) that the whole day should be pleasurably occupied by a trip from Birmingham to Haddon Hall and Chatsworth; and, as a novelty, that the catering arrangements should be undertaken by the Midland Railway Company—luncheon being served during the journey to Bakewell, and tea on the return between Rowsley and Derby. This part, at all events, of the day's outing was a great success; but of the rest little can be said with enthusiasm. Rain was descending while the party were loading up the brakes for the drive to Haddon Hall; a grey leaden sky darkened the lovely scenery round the Hall; and the surroundings of Chatsworth were dismal to behold. The half hour or so spent examining the treasures of the Duke of Devonshire's stately home was a welcome relief to the holding up of umbrellas that was an affliction all day; but there was no time, even had there been any inclination, to visit the lovely gardens surrounding the place. Much sympathy was expressed with Mr. Meiklejohn, at the upsetting of the arrangements that had been made for a day's enjoyment; and the party broke up hoping for better luck next time with the weather.

THE WOODALL-DUCKHAM VERTICAL RETORT-SETTINGS.

Continuous Carbonization an Accomplished Fact.



View on Top of the Two Beds of Four 25-Feet Woodall-Duckham Vertical Retorts at Bournemouth, Showing the Coal-Hoppers, the Feeding-Rolls, the Bifurcated Shoots to the Retorts, &c.

In another part of the "Journal," we report the proceedings during the visit last Thursday to Bournemouth of the Southern District Association of Gas Engineers and Managers, on the invitation of the Chairman and Directors of the Gas and Water Company, whose Engineer and Manager (Mr. H. W. Woodall) is this year the President of the Association. The visit was expected to be one of exceptional interest. The expectation was fulfilled; for the visitors were privileged to witness that continuous carbonization in closed vessels is now an accomplished fact. In other words, they saw in actual work the continuously charging and discharging vertical retorts on which the President, in conjunction with Mr. A. M. Duckham, has been working assiduously for some four years; and what the visitors witnessed—accustomed as they are to the smoke, dirt, and intermittent operations of an ordinary retort-house—was something worth going far for. The two settings of fours at the Bourne Valley works represent the latest construction there; but yet experience since their erection has pointed the way to certain further improvement. Nevertheless the results at present secured, as will be shown, promise much. What has now to be done, as soon as settings are at work elsewhere, is to demonstrate the commercial advantages of continuous working in comparison with ordinary systems; and we are hoping, though the way has been long to the present stage—long because of the virgin soil that has had to be worked upon to attain the end in view—that the commercial advantages of the system will soon be conclusively proved. In the course of this article, we shall be giving some figures which show fairly (as we have seen from an examination of the hourly and daily working records) the results from the present settings.

Impressions.

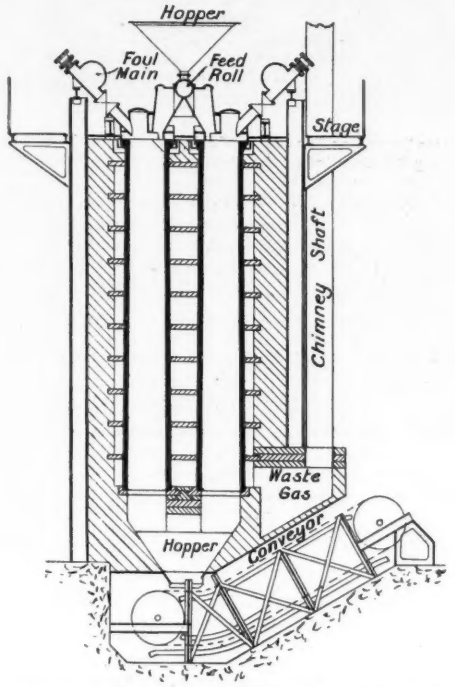
It would have been of great interest to have gathered the individual impressions of the numerous professional inspectors of the settings and working on Thursday last. It was strange to see the large square brick erections, destitute of mouthpieces and all the heavy mountings that custom has associated with the retort-house; strange to think that within each setting there were four retorts 25 feet long in which the carbonization of coal was proceeding, controlled entirely by the governable rate at which the spent portions of the charges were being systematically removed at the bottom of the retorts; strange, knowing this, to be able to detect no smoke, flame, dirt, steam; to see no rushing about of men; to hear nothing of the noise inseparable from ordinary retort-house operations; to see no charging and discharging machinery moving up and down the house; to find only a couple of men on the installation—one at the top of the bench whose heaviest labour is that of "watching the wheels go round," and keeping things clean and lubricated as the attendant would do in an engine-house, and the other man engaged at the bottom wheeling away the coke, as the retort-conveyors deliver it into barrows (inasmuch as a transporting conveyor is not yet of the equipment to receive delivery of the coke); and to learn that these men could, given a conveyor to remove the coke, easily, and have a lot of time to spare, keep an eye on, and give all the attention necessary for a plant making a million cubic feet of gas a day——well, the most conservative among us must devoutly hope that continuous carbonization will prove, and that quickly, a great commercial success. With such plant, if it demonstrates its general superiority over the ordinary carbonizing methods, an engineer and his staff could in a labour emergency preserve a town from being entirely deprived of gas. But that is not all. We look for the ascension-pipes; and the celebrated chapter on "Snakes in Ireland" comes at once to mind, for we might with truth say "there are none." The hydraulic main with all its dirt and difficulty has disappeared, as also the dip-pipes. What need is there of them when no doors are ever opened, and the whole operation is carried out in sealed vessels? There is about 2 ft. 6 in. of connecting-pipe (including the valve) running slantwise at the top of the retort. But nothing more. Stopped pipes are, under this system, things of the past. That is the experience of the last four years, during about three quarters of which time vertical retorts, in various stages of development, have been working, and during the whole of that time on no single occasion has there been such a thing as a stopped pipe. The setting of four that preceded the present settings was making gas and supplying into the town for eleven months; and there were no stopped pipes. What is also of great importance suffering gas managers will concede, is that naphthalene has not been traced, and there are no naphthalene troubles. Money now spent on clearing ascension-pipes; money now spent in connection with the naphthalene difficulty; and any other difference produced by the new as compared with the old systems, must be entered in the balance-sheet in determining the commercial value of continuous carbonization.

Early Work at Bournemouth—Difficulties Met to be Overcome.

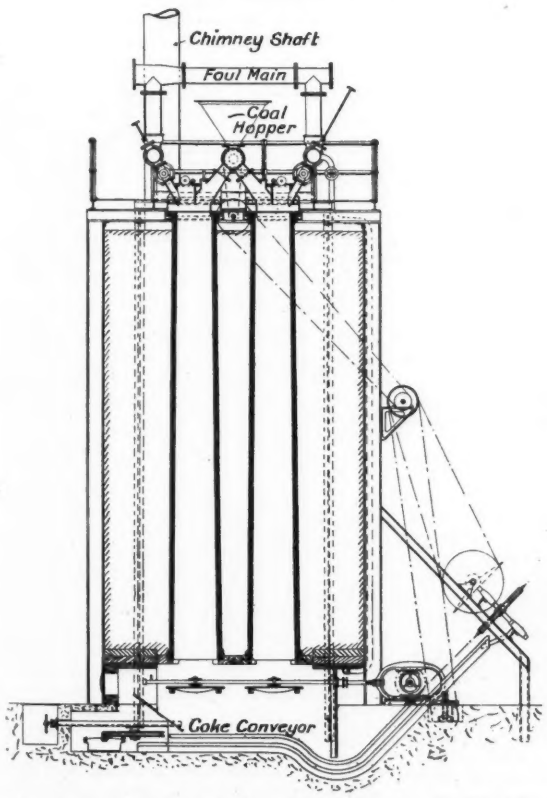
A great deal has been made of the reticence of Messrs. Woodall and Duckham in giving information up to the present about their process of continuous carbonization in vertical retorts. We are not apologists for them; they do not need any. The process is their own; and it has been others and not themselves who during the developing and the probationary period have talked of the system and of its prospects. Let it be remembered that they attacked a many-sided problem—one that had never been attacked on the same lines before; and they had to feel their way. It was a question of designing first the component parts of what they believed would work, and then to amalgamate them to make a working entity. Every part of the plant, every operation, must have, in such a system, an interdependence; and as working proceeded, every part of the plant and every operation had to be little by little modified, or be entirely discarded and replaced, until the properly organized system, with each part indis-

pensable to, and working smoothly with, the others was secured. It meant much doing and undoing; for it was indeed a knotty and complicated problem that these intrepid investigators set out to solve.

Let us go back in history a bit, and by illustration just lift one corner of the curtain to show what has had to be done, without entering into details. The first vertical retort put up at the Bournemouth works in 1903 was a single one, 10 feet long. This retort never really worked, owing to difficulties in heating. The next retort was a single vertical one, 20 feet long; and this was worked for a period of practically twelve months, with, from the figures we have seen, extraordinary results in make but of rather low illuminating power—about 10 candles. But there were other drawbacks. The retorts to this stage were all water-sealed at the bottoms. They led up to the first setting of four vertical retorts. In this case, the retorts terminated in a common hopper



Cross Section of First Setting of Four Retorts Erected on the Woodall-Duckham System.



Cross Section of Present Setting of Four Retorts on the Woodall-Duckham System.

and common conveyor at the bottom. The coke was extracted by this conveyor; and the rate of carbonization was controlled by the speed at which the conveyor was run, which was about 18 feet per hour. The chief trouble experienced with this setting was the lack of positive control of each separate retort, and the fact that—the rate of carbonization being dependent on the rate at which the conveyor was run—it was impossible to remove the coke through the water seal at a sufficient pace to prevent undue quenching. The coke, in fact, was under the water for some twenty minutes. We are enabled to give drawings which show first the old arrangement, and secondly, the means adopted, in the present settings, to overcome the troubles.

Bottom Regulation the Controlling Factor—The Question of Coke Quenching.

Perhaps it would be well here to impress upon readers this fundamental principle affecting the working of the Bournemouth verticals—that the whole of the regulation of charging and discharging the retorts, and the duration of carbonization, is effected at the bottom of the retorts. In other words, the rate of discharge regulates the feed, and therefore the rate of passage of the charge through the retorts. If this is borne in mind, much else will be readily understood as we proceed. Now in the existing settings, there is a special pushing device under each retort, which ensures a positive feed to each retort entirely independent of the others in that setting; and an entirely independent conveyor is also provided under the retorts for the removal of the coke as it is discharged by the pushers, which can be run at any desired speed, without affecting the rate of carbonization. The conveyors gave a little trouble at first; but the right kind, of the right strength, has now been determined. However, it is the special pushing device that is the determining factor in ensuring continuous carbonization. The question of coal and coke conveying are quite extraneous to the process under discussion, the success of which is dependent on the combination of the coke discharging device and the special coal feed, which together ensure that the retort is always full of coal and coke, and yet the charge never jambs. By these latter-day means, the necessity for which has taken time to discover, and then to devise and perfect, the coke can also be extracted without being unduly quenched—in fact, observation confirms the statement of the inventors that the coke by the present arrangement is not under the water for more than about 10 seconds—from the time it goes into and is clear of the water. Indeed, most of the coke is now so hot on being delivered from the conveyor that it cannot be held in the hands. This is our experience; and it at once disposes of the questions that have been raised as to the deterioration of the coke through a too long subjecting to water, and as to the large proportion of water that the coke contained under the cruder conditions of earlier experiments. There was undoubtedly some ground for the opinions at one time entertained on this score, and opinions that became somewhat exaggerated while the inventors were at work rectifying the difficulty. But now, as we say, the coke is so hot that the moisture in it due to its brief immersion is rapidly dissipated. Comparison of the drawings will show the changes in the construction of the conveyor and in its course that have produced this result.

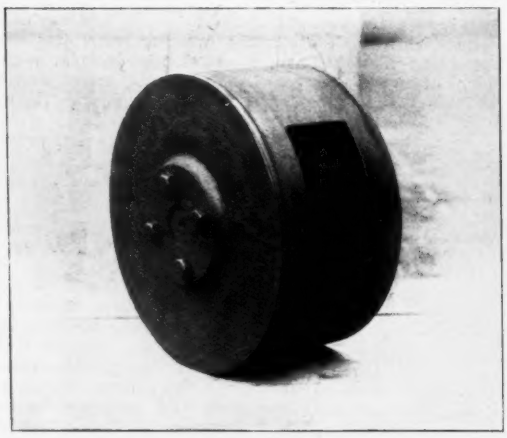
The Settings and Operations in Further Detail.

Now that we have disposed of the point as to the control of the feed at the top of the retorts depending upon the operations at the bottom of the retort, and of the associated one as to the rapid passage of the coke through the quenching water, we may glance at the setting a little more in detail; and the drawing of the setting as it is to-day, but which has still to undergo certain further improving modification (the results not being up to the point the inventors have confidence they will attain), will materially aid the reader in comprehending the features to which attention will be directed.

As already mentioned, in the two settings at the Bourne Valley works, the retorts are arranged four in a setting. They are 25 feet long, with a sectional area of 24 in. by 10 in. at the top, and 30 in. by 22 in. at the bottom; the thickness of the wall of the retort being 3 inches. The charge in each retort rests on a cast-iron plate, on which the pusher works. The pusher, it is incidentally worthy of note, is hollow, and is cooled by water. Each pair of pushers is worked tandem by a special reciprocating device—a double rack and half pinion, clearly shown at the bottom of the second drawing. As the pusher goes in the half pinion gears with the top rack, and pushes it in. When the pusher gets to the end of its stroke, the pinion disengages from the top rack; and a very small portion of a revolution causes it to engage in the bottom rack, and the return stroke is commenced. The working was watched and greater precision of action could not be desired. The pinion itself makes only one revolution an hour; and when this is being done, 2 tons of coal per retort is being carbonized in the 24 hours. But Messrs. Woodall and Duckham are aiming at 3 tons per retort; and they are sanguine they are going to do it on the completion of certain adjustments which they have arranged to effect in the setting.

The Feeding Arrangement.

It has been made quite clear that the whole operation of the retorts is controlled by the pushing device, because, as the pushers discharge the coke from the supporting plates, the charge



The Cylindrical Charging Device, which Automatically Receives from the Hopper and Ejects into a Pair of Retorts as Space Permits.

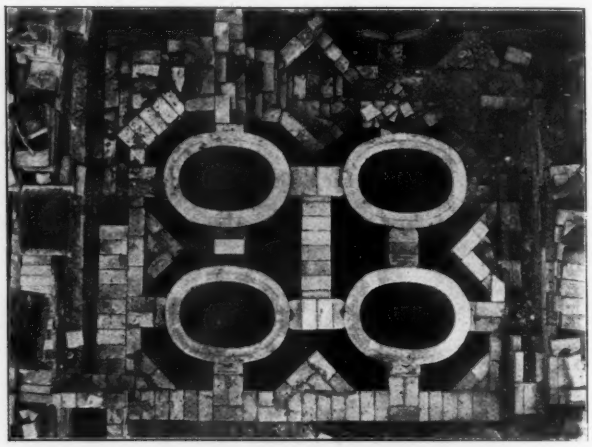
settles in the retort, leaving a space at the top, which is immediately filled with coal by an automatic rotary charging device. This device is a cylindrical vessel working in a drum; and it has upon the periphery of its body, one opening through which the coal is received from the feeding-hopper above, and out of which the coal, as space allows, is fed into the retorts. It is very interesting to watch the action of one of these feeding devices, and its reception of coal from the hopper, after making a discharge into one or other of the two retorts which each feeder serves through a bifurcated shoot. The coal in the hopper is in alternate states of quiescence and movement—the merest trickle—into the cylindrical feeder. Yet with the almost imperceptible motion, no less than 4 tons of coal passes—not by any guesswork but by actual weighing—through one of these feeding devices per 24 hours; each retort, as has been said, dealing with 2 tons each per day. The feeder, by the way, has a capacity of about 30 lbs.; and it makes twelve revolutions a minute—feeding not 30 lbs., but small quantities, dependent on the space available, into each retort on an average six times a minute. The feeding device is driven off the same shaft as the coke-pushers at the bottom of the retorts; so that the pushers take out exactly the same quantity of coke from each setting, and the space left is immediately filled with coal by the feeder. But, as remarked, fresh coal cannot be put in until coke is removed, and the charge has settled, and space provided at the top; but there is always the coal in the revolving device ready to drop, as opportunity offers. In this way, no undue pressure can be brought to bear on the retorts; and there can be no jamming of the charges.

Miscellaneous Details.

While on top of these 25 feet length retorts, there were two or three other points that were noticed. One was that, practically in the centre of the top cover of each retort, a hole has been made into which a large iron ball fits, through the centre of which ball a hole has been drilled. When the ball is lying in its bed with the hole through it in a horizontal position, a perfect seal is made against gas egress or air ingress; and, by turning the ball so that the hole is in a vertical position, the attendant can, with the aid of a rod, feel exactly the position of the charge, without losing gas or drawing in air. There are no hydraulic mains, or (as we have previously shown) nothing that can be called ascension-pipes or dip-pipes; the reason for the absence of them being, of course, obvious—there being no doors to open, the retorts being self-contained, and the operations entirely mechanically controlled. If constant conditions in retorts are necessary to efficient carbonization, then here we have conditions which are unvariable from hour to hour throughout the day. Once set to work, the retorts simply go on working. There is nothing to do and practically nothing to touch; and what the inventors have had to prove first was that they could, working as it were automatically, get the charge down regularly, the spent coke removed regularly, and fresh coal fed in regularly. This they have succeeded in doing; and thus we have, at any rate, attained continuous carbonization. The results are a distinct matter.

The Space Occupied—No Retort-House Required.

Space in relation to output is an important consideration. The brickwork of the setting of four retorts 25 feet high, each dealing with 2 tons (and it is hoped shortly 3 tons) of coal per 24 hours, occupies an area of 9 feet by 15 feet. In front, about 15 feet is required by the conveyors, and for attention to them; so that the ground area required is 9 feet by 30 feet for each setting of four retorts. It should be noted in this connection that it is claimed for this system of working—there being no lids or doors to open—that no retort-house is required. As a matter of fact, the setting that is under slow fire at the present time at the Linacre works of the Liverpool Gas Company is out of doors; while that at the Nine Elms station of the Gaslight and Coke Company is in a house. If it is proved that retort-settings on this principle need



The Camera Turned on Top of the Woodall-Duckham Vertical Retorts During Construction at the Linacre Gas-Works, Liverpool.

no habitation, but nothing more than an erection over them to shield the attendants from weather inclemency, and to protect the coal in the hoppers from rain, there is capital expenditure to be saved here. In this connection, we have an interesting photograph looking down on the top of the Linacre setting during construction.

Fuel Account.

The fuel account we gathered has been down to as low as 15 per cent. of the coal carbonized.

The Labour Account.

Working on these two settings, the carbonizing wages have been reduced to under 1d. per 1000 cubic feet; and working properly with a number of settings—say, five of four verticals each—equal to the attention of the men now engaged watching the retorts automatically doing their work, carbonizing wages could, it is believed, be brought down to something like ¼d. per 1000 cubic feet.

The Power Required.

The power required for operating the system is almost ridiculously small. Standing on the top of the benches, and watching the smooth, quiet, and easy movement of the charging devices, and then going below to inspect the working of the conveying plant, it is patent that very little power is needed to drive the whole plant. An installation to make ½ million cubic feet of gas a day would not require more than 5-horse power to drive all the moving plant; and in this installation at Bournemouth, not more than 3-horse power is being used—including the driving of the feeding arrangement and the coke-conveyor.

Character of the Coke.

The coke as now produced from the retorts is clean, hard, and of silvery appearance—in fact, it is decidedly good to look upon. But, so strong does custom root itself, that at first the colour not being the same as of old, consumers temporarily thought there was just cause and reason for complaint. But this was only a transient matter; and now the vertical retort coke is taken readily. The hardness of the coke will be easily understood when it is remembered that before it is removed from the bottom of a retort, it has had the weight of a gradually increasing column of charge upon it until the full length of 25 feet has been reached.

The Results.

We next give the results of the working with the settings of retorts as at present standing; but it will be borne in mind by readers that Messrs. Woodall and Duckham have certain ideas materially shaping themselves which they are convinced are going to result in a substantial gain in the results. There was one thing upon which we were able to satisfy ourselves—not that we the least doubted the honesty of Messrs. Woodall and Duckham (far be that from anyone's mind), but because it is useful to be able to make attestation to this effect—and that was their independence in the matter of the working records, daily and weekly, which were inspected. We found the coal that was being used was being taken from by not any means recently stocked coal in the yard; and the men were weighing and bagging it before elevating it to the hoppers on top of the bench. The vertical retort attendants take the readings of the meters; and their readings are checked by the works' foreman. The men also weigh up the coke used for fuel; and record the vacuum at which the retorts are working. At the far end of the works, the works' chemist and his staff take the illuminating power of the gas, the calorific readings, and make their analyses of the gas. They also keep the records of the tar and liquor made. Before, however, the gas is tested in any way, it passes through a condenser all round the retorthouse, an 18-inch condenser on the retort-house wall, through the washers and scrubbers put in for 1,500,000 cubic feet per diem, a set of 25 feet square oxide purifiers, and about a quarter of a mile

of 24-inch main. It is then metered in a station meter (1,500,000 cubic feet capacity); and the various tests for composition, illuminating power, and calorific value are then made. The figures, in fact, are the ordinary works' readings of ordinary working, and nothing more; but the illuminating power is taken every hour by the "Metropolitan" (Carpenter) No. 2 burner, with the carbonic acid left in the gas, once an hour day and night; and the calorific power is registered twice an hour. The figures, however, are only submitted for their passing interest, and not as final. The present settings were first put to work on May 6.

Average Working Results for the 22 days up to May 27.

Cubic Feet of Gas. Per Ton.	B.Th.U.	Illuminating Power. Candles.
13,021	546	14·20

A Run of Good Daily Makes under Present Conditions.

	Cubic Feet.	B.Th.U.	Candle Power.
May 11	13,502	546	15·06
„ 12	13,916	540	13·29
„ 13	13,918	540	14·80
„ 14	13,835	532	14·37
„ 15	12,906	556	15·27

Composition of the Gas.

	Per Cent.
CO_2	1·8
Hydrocarbons absorbable by bromine	3·6
CO	8·2
CH_4	23·8
H	54·8
Residue estimated as nitrogen	7·8
	100·0

Specific gravity, ·46.
There is no naphthalene; and only a small trace of cyanogen present in the gas.
16·7 gallons of tar were made per ton (sp. gr. 1·075).
42·3 gallons of 8-oz. liquor were made per ton.

From these figures readers can, bearing in mind that they are not to be taken as final, make their own deductions.

Regarding the composition of the gas, it is very satisfactory to note that, on the three weeks' working, the average of carbonic acid is only 1·8 per cent. Another interesting point is the "residue estimated as nitrogen." It is very high. In previous tests, this has been as low as 2·8 per cent. But testing for the composition of gas is a very delicate operation; and the particular test given to us was made in the Company's own laboratory. It is probable, therefore, that the 7·8 per cent. includes a certain amount of undecomposed hydrogen and methane. The test was merely handed to us because it contained the only actual figures obtained on the settings now in operation; but it would not be correct to assume from them that there is 1·8 per cent. of carbonic acid and 7·8 per cent. of nitrogen—equal to 9·6 per cent. of inert gases—present. With respect to naphthalene, by the most delicate test that the investigators have been able to apply, they have never yet been able to obtain a trace of it. So far as cyanogen is concerned, they have only been able to obtain a trace, and have never realized a sufficient quantity to measure. The reason attributed by Messrs. Woodall and Duckham for there being neither naphthalene nor (in measurable quantity) cyanogen present in the gas is that the coal is subjected to a process of fractional decomposition—each fraction coming over at its own critical temperature, and never having to pass through any temperature higher than that at which it is evolved. This explains the difference in the quality of the tar—the tar not having been subjected to any decomposing action. It is a very light brown tar, and contains a larger percentage of lighter oils than ordinary tar; and its consistency is about that of water-gas tar. It can be returned (this is a very simple matter) to the retorts, and is then decomposed; so that the make of tar is in the hands of the engineer. In the case of the experimental single-retort setting, the tar was returned, in a very easy way, and yielded satisfactory results—an increased make of 1500 to 2000 cubic feet of gas per ton of coal being the result.

This completes the information that we have at present to give regarding the Woodall-Duckham continuous process of carbonizing coals to the point that practice has carried it. Research has taken it, it is believed, farther still; but the rights of the inventors have very properly to be observed. How much better results they will be able to give us in the future, only actual working can reveal. Then the whole balance-sheet on a financial basis, taking a hypothetical case if the inventors like, should be worked out in comparison with the best of ordinary systems. For new systems must stand or fall on a thorough commercial valuation. We are hopeful of the future, from what has been seen and from the achievements set forth above. With us, all will concede that Messrs. Woodall and Duckham have proved the feasibility of continuous carbonization; and that their invasion of the regions of research has given much of great technical interest and value.

We have received from Messrs. John Allan and Co. "The Distribution of Gas," by Mr. Walter Hole, the Superintendent of the Mains and Distribution Department of the Leeds Corporation. It is a reprint of a series of articles contributed to the "Gas World," with an additional chapter on "Fusion and Electrolysis." The book, which we purpose noticing more fully in a subsequent issue, has a preface by Mr. Thomas Newbigging.

THE ROAD-TARRING COMPETITIONS.

THE weather conditions on Monday last week were sufficiently good to admit of the trials of the tar-spreading machines entered for the competition promoted by the Roads Improvement Association being completed on that day. We understand that the seven competing machines, which, as already reported (*ante*, p. 575), had been tested on the Hounslow-Staines granite road, and on the gravel road near Ascot, on Monday spread tar upon some quarter-mile stretches of the flint road beween Twickenham and Kempton Park. The road was closed to general traffic, and, consequently, the operations of the machines were not interfered with as in the previous trials; and the Staines Urban District Council, who are the Highway Authority for the Kempton Park road, deserve great praise for the excellent provisions made for the competition, so far as it was held within their district. In such a matter, it is evident that the active and intelligent co-operation of the Highway Authority is absolutely essential; and the thanks of all interested in the future of tar as a road-surfacing material are due to the Middlesex and Berks County Councils also for allowing important roads under their control to be used as trial grounds for the spreading-machines and the preparations of tar. It is conceivable that a well-meaning but misguided competitor might injure the roadway to an extent which it would take long to repair; and while there is no reason to suppose that any such injury has been done in the course of these trials, the public spirit of the Highway Authorities concerned, and their Surveyors, deserves the fullest recognition. May the benefit accruing to the public and the road-makers throughout the country, as the result of these competitions, be so great as to justify the Councils and Surveyors for their co-operation in them.

Our report last week was necessarily incomplete as to some of the trials; but with what has just been said in regard to Monday's operations on the Kempton Park road, it should suffice until the Judges' Committee have made their awards. It appears, however, that the "Solidified Tar" which, as reported last week, was one of the materials entered for the competition for the best preparation of tar for treating roads, has not been laid on the portion of road allotted to it, and some other preparations have only covered part of the sections apportioned to them.

Whatever the awards may be, most of the competitors, and all the Road Surveyors and Engineers who attended the trials, will have profited therefrom. The practicability and utility of road-tarring by machine-spreaders have been demonstrated beyond question; but it would be absurd to suppose that the machines have yet attained perfection, or that the best preparation or description of tar has already been discovered. The competitions, however, will have served their main purpose, if they shall have directed attention to the lines which subsequent improvements of the machines should follow, and have indicated the directions in which the most promising descriptions of tar should be sought. There seems little doubt that gas-works will have a virtual monopoly of the supply of the tar, whatever the precise nature of the variety which receives the palm. There is also little question that whatever preparing the crude tar may require, the better to fit it for the treatment of roads, the process of preparation must be a simple one which can readily be carried out on gas-works. The outlet which will thus be afforded for a considerable proportion of the tar produced should put the gas manager in a position to obtain much better terms than he does at present from tar distillers for the remainder of his make of tar.

Masonic.—Two appointments announced last week will be of particular interest to gas engineers. Bro. William Prince, of Stoke-on-Trent, has been elected and invested as Provincial Grand Treasurer for Staffordshire; while Bro. R. G. Shadbolt, of Grantham, P.M. of the Northern Star Lodge, has been appointed by Lord Stanley as Provincial Grand Senior Deacon for East Lancashire. There were in all, we learn, five P.G.S. Deacons invested on Thursday; but W. Bro. Shadbolt was the first one called by the Provincial Grand Master, so that he will be the Acting P.G.S. Deacon for the year.

New Intermediate Product from Thorium.—A recent number of the "Berichte" contained an article on this subject by Herr O. Hahn. From the examination of a number of thorium preparations of various ages, and comparison with thorium minerals, the author came to the conclusion that radiothorium is not a direct product of disintegration of the thorium atom, but arises from an intermediate substance formed in the first place from thorium. This substance appears to have a longer life (and is consequently formed more slowly) than radiothorium. In thorium minerals or very old thorium preparations, the rate of decay of activity is regular—a state of equilibrium between the production of the new substance from thorium and its disintegration into radiothorium having been reached. In freshly obtained thorium preparations, however, the new substance is eliminated in the process of preparation, and the radiothorium retained. Hence the activity, normal at first, decreases abnormally rapidly, for the decay of the radiothorium is not balanced by its production from the intermediate substance, the rate of formation of which is relatively slow. As the new substance is formed, however, and begins to disintegrate, the abnormal rapidity in the falling off of activity gradually lessens (indeed, the activity may for a time actually increase), till ultimately the normal state of things is reached.

BY DAY AND BY NIGHT AT THE DUBLIN EXHIBITION.

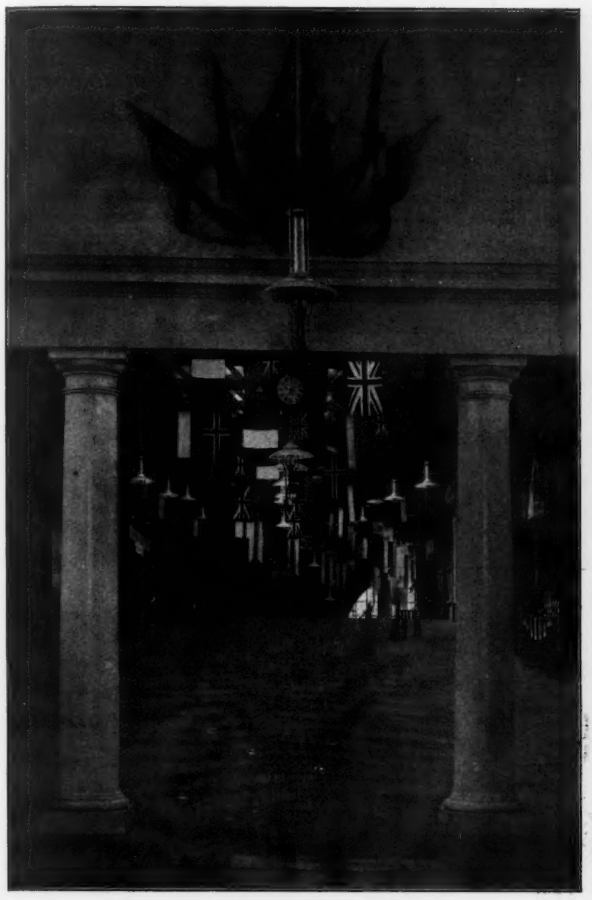
High-Power Gas Lighting in the Grounds and Buildings.

The Gas-Lamps Round the Band-Stand.

The Gas Lighting round the Band-Stand and in the Grand Avenue.

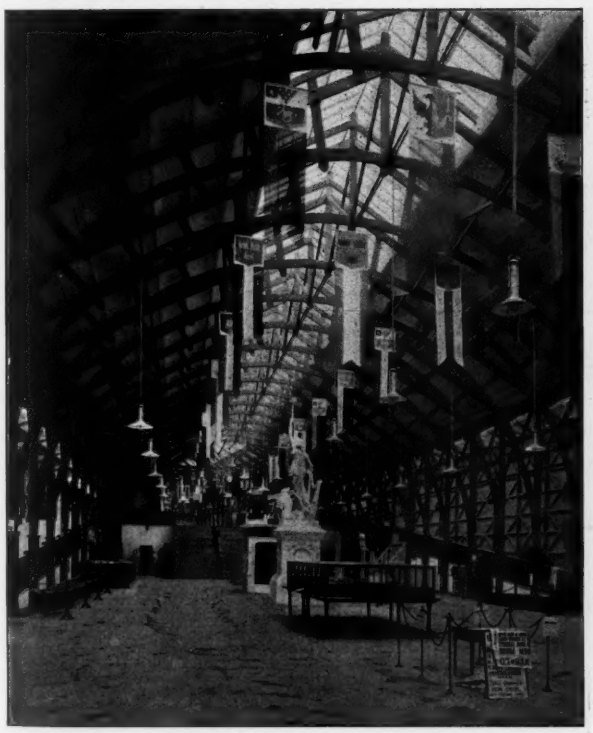
BY DAY AND BY NIGHT AT THE DUBLIN EXHIBITION.

High-Power Gas Lighting in the Grounds and Buildings.



Entrance Hall by Day.

Entrance Hall by Night.

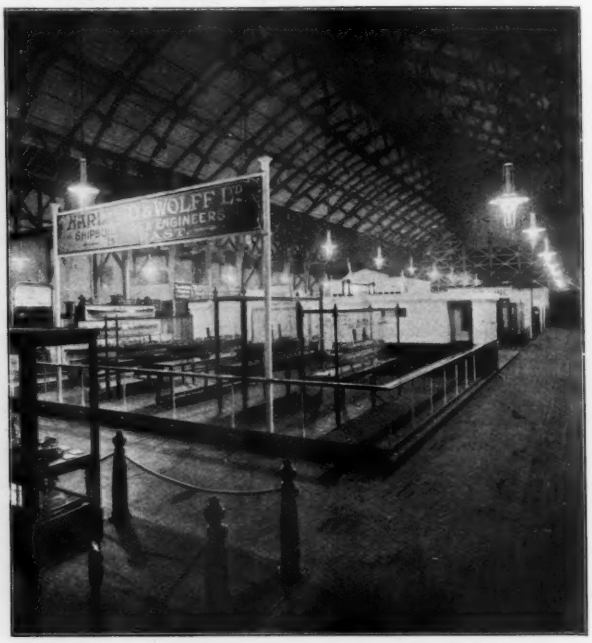


Another View of the Front Entrance by Day.

Another View of the Front Entrance by Night.

An interesting series of photographs has been obtained for us by Mr. Francis T. Cotton illustrating the lighting of those sections of the Dublin Exhibition and grounds which have been allocated to high-power gas lighting. The pictures by day accompanying those taken by night enable one to get an idea of the character of the lamps that have been adopted, and they also permit of an excellent contrast being made of the aspect of the grounds by daylight and by night when illuminated by the gas-lamps. On comparing the

Machinery Hall by Day.



Machinery Hall by Night.

illuminated surfaces of the walks and of the buildings, there is no doubt that the high-power gas lighting everywhere is exceedingly well done. The lighting round the bandstand and in the Grand Avenue, it is evident, has given an exceptional opportunity for making a good display. Looking at the night picture of the Grand Avenue, and at the great dome at the end, it may be mentioned that, although the illumination of the outside of the dome is by electricity, the light coming through the windows is supplied by high-pressure gas-lamps. The photographs of the lighting were taken between 10 and 11 p.m.

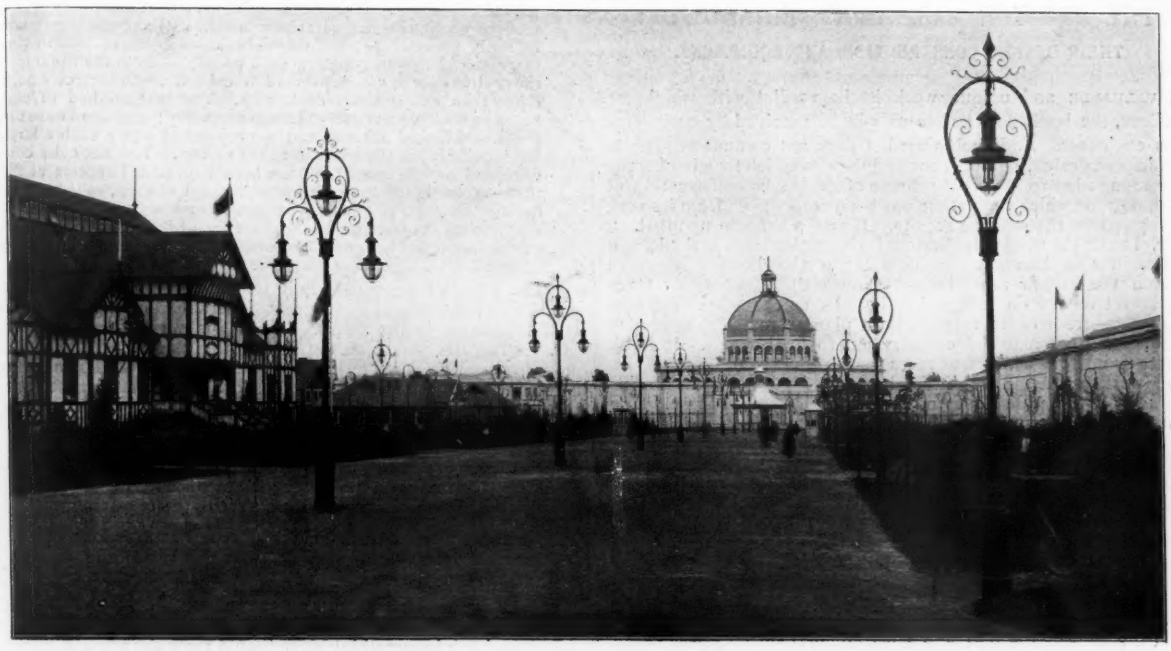
We may remind readers that the firms who are identified with the lighting of special parts of the exhibition and the grounds by means of high-pressure and other high-power gas-lamps are Messrs. William Sugg and Co., Limited, Messrs. James Keith and Blackman Co., Limited, the Welsbach Incandescent Gaslight Company, Messrs. Anderson and Duffield, Limited, and Moffat's Limited.

Messrs. William Sugg and Co., Limited, are responsible for the lighting of the centre and right-hand side of the entrance road to the Exhibition, from Morehampton Road, the front of the Palace of Mechanical Arts, and round the bandstand. In front of the Palace of Mechanical Arts, there are nineteen wrought-iron tube columns, with ornamental cast-iron bases, each surmounted with an ornamental wrought-iron swan-neck and one 1500-candle power lamp. On the right-hand side of the entrance road, there are ten wrought-iron tube columns, with ornamental cast-iron bases, each surmounted by an ornamental wrought-iron harp, and one 1500-candle power lamp. At the Morehampton Road entrance and down the centre of the road, are eleven wrought-iron tube columns, with ornamental cast-iron bases, each surmounted with an ornamental wrought-iron fitment, carrying three 1500-candle power lamps. Round the bandstand are four wrought-iron tube columns, with ornamental cast-iron bases, each surmounted with an ornamental wrought-iron fitment, carrying five 1500-candle-power lamps. The lamps are arranged so that the distance from the centre of the mantles to the ground-line is 16 feet (with the exception of the centre lamps of the clusters). In all, there are 94 lamps of 1500-candle power, giving the magnificent aggregate illuminating power of 141,000 candles. The lamps used are of Sugg's patent "Belgravia" pattern; each being fitted with three 500-candle power high-pressure burners. The pressure of the gas is raised to give 16 inches (column of water) under the burners, at which the highest results are being obtained.

Messrs. James Keith and Blackman Co., Limited, are lighting one side of the Main Avenue—*i.e.*, the path that runs along the side of the Gas Pavilion, two sides of the Grand Central Palace, and the gardens in between the Palace Restaurant and the Tea Pavilion and the Palace of Industries and the Grand Central Palace. There are also eight lamps in the Grand Central Palace itself. In all, the firm are supplying 114 lamps, each of 1500-candle power, divided as follows: 75 columns, each carrying a swan-neck bracket and one lamp; 10 columns, carrying harps with one lamp; and 7 columns carrying clusters of three lamps—the centre one arranged in a harp, and two suspended from swan-necks all in one line. The compressing plant is supplied in duplicate, and is fixed in the Gas Pavilion. The pressure of the gas as it leaves the blowers is regulated to about 20 inches; and the pressure at the burning point is from 16 to 17 inches. The lamps are of the firm's standard pattern (No. 43); and they permit of the air supply to the burners being adjusted from the outside of the globe while

Another View of the Machinery Hall by Day.

Another View of the Machinery Hall by Night.



The Gas-Lamps in the Grand Avenue.

the burners are in use. Each lamp contains three 500-candle power burners, arranged to pass 16 cubic feet of gas per hour at 16 inches pressure. The hourly gas consumption for the whole installation will thus be 5700 cubic feet, giving an illumination of 171,000 candles.

The main entrance-hall and staircase are lighted by 49 of the Welsbach Company's self-intensifying lamps, giving an aggregate illuminating power of about 20,000 candles. The Gas Section of the Exhibition is also lighted by 17 self-intensifying lamps, giving an aggregate illuminating power of 10,000 candles.

Moffat's Limited are also lighting the Entrance Hall of the Exhibition buildings, with 26 "Sydney" inverted cluster lamps, having an aggregate illumination of 6500-candle power.

The "Dacolight" system (Messrs. Anderson & Duffield, Limited) of high-pressure gas lighting is used for the illumination of one section of the Machinery Hall. The apparatus for raising the gas to the required pressure of 12 inches is located in the Gas Pavilion; and it is in duplicate. In the Machinery Hall are fixed 63 large "Arc" pattern lamps, each of which gives an illuminating effect of 1500 candles.

The Lighting of the Grand Avenue by Gas.

Institution of Mining Engineers.—The 46th general meeting of the Institution will be held in the rooms of the Geographical Society, Burlington House, W., on the 13th and 14th inst. According to the programme issued by the Secretary (Mr. M. Walton Brown), among the papers to come before the members are the following: "Bye-Product Coking Plant at Clay Cross," by Mr. W. B. M. Jackson; "Notes on Bye-Product Coke-Ovens, with Special Reference to the Koppers Oven," by Mr. A. Victor Kochs; "Bye-Product Coke-Ovens," by Mr. Paul Schwarz; and "Water Supplies by Artesian Tube-Wells," by Mr. Herbert F. Broadhurst. Among the papers which will be open for discussion is one on "Bye-Product Coke and Huessener Bye-Product Coke-Ovens," by Dr. J. A. Roelofsen. The members will visit the Park Royal electricity generating station of the Great Western Railway, and the Knight, Bevans, and Sturge branch of the Associated Portland Cement Manufacturers, at Northfleet.

Illuminating Power of Different Sources of Light.—In a communication contained in a recent number of the "Zeitschrift für Angewandt Chemie," Herr Lockemann gave the following as the powers, in Hefner units (say 0·9 English candle), obtained for 1 mark per hour from the light sources named: Wax candle, 29; paraffin candle, 117; ordinary gas-burner, 418; argand burner, 556; Edison electric lamp, 662; Nernst do., 1064; tantalum do. 1299; Bayen do., 1818; Bremer do., 8547; alcohol lamp, 1136; petroleum argand burner, 1205; Auer incandescent gas-burner 2632; Lucas do., 3704; "Millennium" do., 5000.

THE GRANTON GAS-WORKS, EDINBURGH:

THEIR DESIGN, CONSTRUCTION, AND EQUIPMENT.*

A VALUABLE and unique work is the verdict with which, we believe, the book now before us will be received by competent gas engineers. And such a verdict does not commit anyone to principles, design, methods, or anything else which together supply the foundation to the great scheme of gas-works construction at Granton for which the author has been responsible from its very inception to the working results. It was a scheme upon which Mr. Herring's whole professional reputation was staked; and here, in this handsome volume (upon the literary merit of which the author must be complimented), without any trace of secretiveness on any point, he tells us the whole story of Granton—from cause to plan, from plan to material organization, and from material organization to final result. It is all there; and told with a frankness that produces fascination. As the work stands, it is left fearlessly to judgment. In that is value; but the value does not come to a dead-end there. The literature of the gas profession is not rich in the publication of so much detail as is here presented concerning any complete scheme of gas-works construction of such rank and dimensions. Mariendorf, the new works of the Consolidated Gas Company of New York, Provan, and other modern works have yielded much that is of interest in the way of general description which we have had the pleasure of publishing in the "JOURNAL," but nothing that enters with such fullness into the details of the scheme as the present volume. The book is unique in the thorough modernness of its contents. For there is such an entire reversal of old practice portrayed, and such a complete application of the new, that it stands as the best and most comprehensive presentment we have of the gas engineering of to-day, and it will stand in the future as an authoritative record of the pitch to which gas engineering had attained at the opening of the Twentieth Century.

It is true that, when the Gas Commissioners of the Edinburgh and Leith Corporations found themselves in more than one "tight corner" in connection with their producing plant at the time of Mr. Herring's appointment, when they had determined to "take the bull by the horns," make a clean sweep of the old, and concentrate their manufacturing operations on one site, their Engineer had before him the whole field of gas practice from which (had he so chosen) to select, and to adapt and fit into a scheme that which was most approved and had upon it the seal of time and efficiency under the circumstances of use. But if Mr. Herring at the time had professionally characterized himself at all, it had been as a devout adherent to the modern school of gas engineers, and of liberal as opposed to conservative tendencies. His position at the time was not precisely one to be envied; his responsibility was great. Gas engineers were then in a vacillating mood. Past methods had served their purpose well; on the horizon of the gas industry, with competition assailing, the necessity of economy of production in bulk and cheapness in retail dealings were taking a more and more defined shape. Labour, too, in the gas industry as in other industries, was, with the march of events, strengthening its position as it had a perfect right to do; and it bid fair to still further strengthen its position. In all industry, such advance in strength has to be met by countermoves, so that the interest of consumers—the backbone of the industry, and the channel through and by whom labour has its existence, its sustenance, and its opportunities—should not be made subservient to the interests of those who only occupy their rightful positions so long as they are the dependents, and not the masters, of the people who are the cause of bringing industry into existence, and maintain it by their patronage. That is a fundamental consideration from which, in the discrimination of relative rights, we cannot depart.

Therefore, in the pursuit of economical gas production, and of meeting increased strength by increased strength, workers in the gas industry had a decade ago taken steps that had those objects for their intent. Thus it was that, when Mr. Herring sat down to consider his plans, projects and opinions were in a somewhat chaotic state. There were the rooted method, the promise, and the rumour. There was the proved and the largely unproved; there were the considerations as to whether past practice would survive as the fittest, or whether changes in chief and auxiliary lines would dominate in the future. The chances had to be weighed, and the die had to be cast, and with the knowledge that when cast it would largely influence the future of gas manufacture and extensions of plant for the important territory under the supply jurisdiction of the Commissioners. As has been said, the responsibility was a heavy one. Memory lingers with Mr. Herring as, with the full knowledge that experience has brought and the comfortable backing of results that his work has achieved, he writes the preface to his book in 1907. He says:—

> The equipment of a works of such a character on so large a scale was a problem that required the most mature consideration; and about this time (1897) the minds of gas engineers were much exercised regarding equipment—in fact, it may be said that the gas profession had then arrived at the parting of the ways. The old order was giving way to the new. But while old systems and methods were established by tradition, new ideas had yet to be proved efficacious. Mechanical appliances such as now exist in a modern works were comparatively novel. Stoking machinery was in fairly general use; but the scientific mechanical handling of raw material and its resulting solid products—from the tipping of the coal-waggon to the despatch of the coke, &c.—had scarcely been other than academically dealt with. The best method of carbonizing coal was a matter of keen controversy; and there were not a few who looked askance at the proposal to equip such a large works wholly on the inclined retort system. The hot-coke conveyor can hardly be said to have been a practical success at the time—certainly not from the author's point of view, as is attested by the fact that, although provision was made for its adoption at the time the contract for the first section of the carbonizing plant was placed, it was not until the contract was nearly finished that the type of hot-coke handling plant was determined upon.

"The proof of a pudding is in the eating." The proof of the wisdom of plan, and of the Commissioners in adopting that plan, is concentrated in the result. But this is not to say that what Mr. Herring did would be the proper thing now under all other conditions. But what he did is what has produced a certain result under certain conditions. His ideal was a practical scheme that should give the Commissioners the greatest possible scope and liberty in feeding their works with material, in handling the raw material and the resulting products in the most economical manner, and by way of the inlets to have outlets, too, giving a like freedom for dealings on the most economical basis. There is good generalship in this. And it follows that in the consummation of such an ideal, in its finished embodiment, we should have a concentration of ideas and modern system and method that give to the volume now under review a value and uniqueness as a perfected and concrete illustration of a large and finished work—finished in its sections, though not in the ultimate number of such sections.

But the book is something more than a mere description of the Granton works. In taking us from the character of the site, and the adopted plans for dealing with it, onwards to the chemical plant, the author stops by the way to discuss alternatives and reasons which weighed with him in determination. Controversial matters come forward frequently, and are not passed by as unworthy of penetration; and the argumentative style of the author in these connections gives piquancy to many a technical point that might otherwise be regarded by some of dogmatic view as merely an ill-considered expression of opinion. It is really a composite volume—a text-book and a detailed description of a large established works within one cover. Right at the outset, for example, in dealing with the site, we have the author discussing foundations in relation to site value, and the bearing the necessary foundations have upon cost. Selection of site is of no less importance than the selection of the plant in its relation to subsequent expenses and working. The same critical examination of comparative values is made in such matters as the mechanical and manual mixing of concrete, the costs of building by direct labour as compared with contract work, and the relative expense of various types of roof construction, and tabulated statements are given in detail, and not simply the totals. With regard to direct labour as compared with contract work in building, the Commissioners show the cheaper results. Even such a minor matter as the relative expense of stone and concrete springer blocks is dealt with in the same careful manner as questions of higher degree. Stone springer blocks of specified dimensions made by contract work in 1902 cost £3 2s. 3d.; and concrete blocks, of like dimensions, made by direct labour, cost in 1904 14s. 1½d. This is mentioned solely as evidence of Mr. Herring's thoroughness in dealing with the details. In treating of the main buildings, not only do we get a description of them as they stand, but, without going into the infinitesimal and commonplace, the constituent parts are described, and also the methods of construction where they facilitated work in comparison with others that offered, are considered. Statements are added showing the comparative costs of stonework and of moulded terra-cotta blocks and buff terra-cotta brickwork, including labour and materials, executed both by direct labour and by contract work. The analysis of the costs and details of the principal buildings contains considerable information of a character likely to be useful for future reference. As the rates of wages, the cost of materials, and other items are given in the fullest detail, all that is required to arrive at similar computations is to substitute the actual price of labour and materials for those prevailing in any given locality, in order to arrive at the unit costs of the various characters of work enumerated. Again, with the roofs (and the retort-house roofs, it will be remembered, are of the semi-elliptical form, which the author so much favours) there is a comparative statement giving the cost and weight of the various types of roofs, reduced to unit basis of metal employed per superficial foot in the first and second sections. And here we can see at a glance the important difference made in such extensive constructional work by the placing of contracts when the markets for material are favourable or unfavourable. Looking at the vast amount of information of this nature that is afforded, we cannot detach from the book an engineering value distinct from the descriptive base and illustration afforded by the Granton works.

First direct experience at Huddersfield and afterwards at New Street, and a comprehensive study of the good points and defects of installations in this and other countries, as all the gas engineering world knows, led Mr. Herring to commit the work of carbonization in the erected sections at Granton to the inclined retort system. He does not compare present working with what might

* "The Granton Gas-Works, Edinburgh: Their Design, Construction, and Equipment." By W. R. Herring, M.Inst.C.E., &c. London: Walter King; 1907. [Price 16s.]

have been had he adopted any other system. But it must be remembered that at the time his determination had to be made horizontal retort working with charging and discharging from one side of the bench, which brings equipment and working into the nearest possible line with inclined working, was a thing of the future. The working and financial results of his inclined retorts, however, are set forth so completely, that anyone approaching the magnitude of working at Granton can make his own comparison. But in considering the figures, it must be remembered not only that the scheme had birth before the system of one-side charging and discharging of horizontals offered itself, but that what Mr. Herring set before himself was that brain and not muscle—that scientific handling of material throughout—should be the dominating factor in the scheme, with the final cost, and not any one intermediate cost, as the determining gauge of success. There is no doubt that a great many of the difficulties with inclined retort settings at the start, and the consequent bad name that the inclined system earned for itself in many quarters, were due to the imperfect understanding of the conditions necessary in the construction of the furnaces and heating arrangements. For example, the construction of the regenerative chambers for a setting of inclined retorts is distinctly different from a similar construction for horizontal retorts. Mr. Herring discusses fully the considerations—the difficulties, the dangers, and the requirements—affecting efficient regeneration for inclined retort settings. From the settings as constructed at Granton, the author claims that the working results (all fully recorded) "show the installation to be an unqualified success from the commercial point of view;" and that "the furnace is well designed and properly proportioned for its requirements is proved by the fact of, firstly, the very satisfactory carbonizing results, and, secondly, the extremely low fuel account—viz., 10 to 12 lbs." Here we are reminded of the famous case in which inclined retorts were the centre around which fiery argument raged. It was the case of *Graham, Morton, and Co. v. Compagnie L'Union des Gaz*. The author deals both tactfully and incisively with the attacks made upon, and the faults charged against, the Edinburgh type of settings (pp. 87-91); but we will not detract from the peculiar interest that these pages of the book will have for gas technicians, in view of what transpired at the trial. The justification, however, for dealing with the matters in this volume may be quoted—

> I have felt it necessary to mention these facts, as the technical points at issue were not as clearly brought out at the trial as a technical man could wish, and in view of the fact that my own work and design was so much in evidence and to a great extent on trial—not by the Judge sitting as a jury so much as by my *confrères*—that this opportunity of concisely stating the facts is naturally one not to be missed. It was perhaps in the description of the working of the Milan settings, which are identical with the Edinburgh settings—as distinct from the producer and the regenerator—where the most lamentable confusion prevailed.

From the latest form of construction for inclined retort-benches, attention is turned to retort-bench mountings and connections; and then the coal-handling plant and the coke plant are fully described. In considering this section of the volume, it has to be borne in mind that here labour-saving appliances were introduced into this scheme to an extent not theretofore attempted in this country. They had been introduced piecemeal into existing works, and incorporated in part in new works; but Granton was intended to be at that date, and is, a complete labour-saving scheme from entrance to exit. Notwithstanding, the author claims that the constructional costs of the works have not been more than the best examples of works built on the old lines; and, so far as experience goes, it costs no more to maintain the mechanical plant than it formerly did to provide shovels, wheelbarrows, and similar tools. This is the testimony of Granton; and it has the corroboration of Berlin, as is to be seen by the article by Herr E. Körting, which appeared in the "JOURNAL" for Feb. 12. There are certain commercial advantages in the mechanical handling of material, the financial value of which can only be shown by the final result, and by contrasting that result with the one that would be achieved by former methods under precisely similar conditions. "It may be claimed," the author submits, "that modern works with complete mechanical and labour-saving equipment do not to-day cost so much as the old-fashioned type, where the raw materials and solid residual products are handled wholly or mostly by manual labour." This has, of course, to be considered in the light of any modifying current costs of structural material and labour. There is much more to the same effect to be gleaned from the book—all certifying the superior virtue of mechanical work, when a proper choice and a proper combination of plant are made.

There are a thousand-and-one features about works such as those at Granton, and in a book such as that before us, that invite notice. But in a review we cannot mention points affecting all. As we read on in succession, we are introduced to considerations and actualities concerning plant for generating steam, storing coal, making briquettes, condensing and exhausting, water-gas plant, washers and scrubbers and cyanide plant, liquor and tar separators, &c. We pause here. Each section of the Granton works is a complete and independent unit. Of course, such concentration and sectionizing of plant as Mr. Herring has adopted can only be economically followed in works on an extensive scale; and there must be fine judgment as to the limits where economy cannot be exceeded before going in for divisibility.

Turning to the section of the volume dealing with the purifiers, it is seen that Mr. Herring has favoured the water-lute type. He gives his reasons for so doing. We have here the same fullness of detail as to construction and working methods; and, in connection with the latter, interest is aroused over the purification of air (for the purpose of arresting odours) after being used for revivification *in situ*. Attention is also directed to considerations affecting the corrosion of iron and steel structures; and free circulation of air and wind is found to be a great protective. In fact, the author is satisfied that the ironwork of purifiers exposed in the open yard is much more durable than when it is contained in a masonry building of any description. The meter-house, pumping-station, &c., are treated upon; and then we arrive at the portion of the book dealing with the four-lift gasholder, 250 feet in diameter and 139 feet deep, on the Granton site. The turbo-exhausters for high-pressure gas distribution, and the high-pressure main system itself, provide an interesting section. Incorporated in the high-pressure system are mains ranging from 15 to 48 inches in diameter; and altogether there are 14 miles of them. The author "cannot speak too highly of such a system for penetrating suburban districts." Full details are also given of the chemical works and their operation. Then we have the constructional costs, and the results of three years' work. From these the engineering efficiency of the plant can be adjudged.

It is impossible to take more than this cursory view of a volume so crowded with detail, and with every page permeated by matters of engineering interest. Foundation to the volume was given by the series of articles published in the "JOURNAL" in 1903; but that foundation has been much amplified by the author, as will be gathered by the mere mention of the fact that the letterpress (divided into 31 chapters) and index, without the lists of contents, cover 289 foolscap pages, in double column, and beyond there are 27 lithographed plates, giving full details and arrangements of the plant, together with a map of the Commissioners' district of supply, showing the existing large high-pressure trunk mains and prospective extensions, which will render even more perfect and efficient than it is at present, the feeding of every part of the varied-levelled area. The letterpress is illustrated by 231 reproductions of photographs of parts of the work during execution and in the finished state. This plentiful illustration is of valuable assistance in presenting to the mind's eye much that it is impossible to convey by typographical aid alone, even through the pen of so lucid a descriptive writer as Mr. Herring. There are also numerous statements giving costs of works in detail and in whole, and working and financial results; and in appendices we have the specifications and detailed schedules of quantities for the brick and puddle tank and the four-lift telescopic holder which was erected in connection with the first section of the works.

In this volume, the author allows all to critically examine every matter associated with the plans and designs of, and the results achieved by, what may be the masterpiece in the exercise of his engineering art. It is a virtue on the part of an author to be able to write so fully of his own work without pretentious display. Mr. Herring's view is that a special engineering work should have its details placed on record for the common good, and that is the first reason for the production of this volume. He does not, therefore, present the book as a testimony to his skill in the art to which he was born; but those who study the volume cannot but make (as those have done who have seen his work) ungrudging recognition of the master mind that directed to the attainment of a certain end. We entertain the belief that the volume will take rank as a standard work on present-day gas engineering.

The Gas Business in Canada and the States.

A representative of Moffat's Limited, who has just returned from an extensive four in Canada and the States, informs us that in the latter country particularly manufacturers of gas appliances are kept extremely busy; and he says it appears to be quite the rule to have orders on hand lasting them for five or six months. This suggests that no slump in the gas-producing business is imminent. We learn that gas companies are giving careful attention to the question of efficiency, both of lighting and cooking apparatus. For them and gas engineers alike the present watchword seems to be "Quality." Manufacturing engineers are working hard to turn out better grades of fittings and appliances, while paying less attention to the cheapest lines; and in this way they make things as difficult as possible for the electric light man. What particularly impressed our informant on the other side was the obvious effort to produce a superior type of Showroom Manager. The fact seems to be fully appreciated that there is more for this man to do than merely reciting the claims made for any particular appliance, and acting in a limited way as a "pocket dictionary of local gas information." The "new" Showroom Manager is less of an order-taker and more of a man of sense and a student of human nature, who understands how to interest an inquirer, hold his attention for a sufficient length of time, and thoroughly take the other man's point of view in the matter. He naturally understands the art of talking practically and to the point about his prospective customer's requirements, and he feels exactly when the moment has come for the transaction to be completed.

Manchester District and Yorkshire Junior Gas Associations.—Next Saturday, the members of these Associations will pay a visit to the works of the Longwood Gas Company, on the invitation of Mr. J. H. Brearley, the Engineer and Manager.

INSTITUTION OF GAS ENGINEERS.

Programme for the Annual Meeting.

In a previous issue of the "JOURNAL" (*ante*, p. 291), we gave the titles of the papers to be read at the forthcoming meeting of the Institution of Gas Engineers, which, as already announced, will be held in the Lecture Theatre of the Royal Dublin Society from the 18th to the 20th inst., under the presidency of Mr. CHARLES HUNT, M.Inst.C.E. We are now in a position to furnish, from the programme which has been issued, some additional particulars in regard to the meeting.

On the opening day, the proceedings will commence at half-past ten with a welcome, by the Right Hon. the Lord Mayor of Dublin (Councillor J. P. Nannetti, M.P.); and acknowledgment will be made by the President. The routine business will then be disposed of, and the Council will submit their report, which is given below. The medals awarded for papers read at the last meeting will next be presented; and the President will deliver his Inaugural Address. Time permitting, a start will be made with the reading and discussion of papers before the adjournment at about two o'clock. In the afternoon, the members will assemble at the main entrance to the International Exhibition (a view of which is given on p. 643) at four o'clock, when, under the guidance of Mr. James Shanks, J.P., the Chief Executive Officer, and the members of the Executive Council, they will visit the various portions of the building. In the evening, they will assemble in the Gas Pavilion, and, after viewing the exhibits, will inspect, under the leadership of the Chairman of the Works, Lighting, and Machinery Committee (Alderman Cotton, D.L., J.P., the Chairman of the Alliance and Dublin Consumers' Gas Company), and other members, the various systems of outdoor lighting, some of which are shown on pp. 643 and 645. To the afternoon and evening functions ladies are invited.

On the second day, the chair will be taken at ten o'clock; and the first business will be the presentation of the annual report of the Committee of Management of the Benevolent Fund, with the accounts for the twelve months ending Dec. 31 last; and the further reading and discussion of papers will occupy the members till the midday adjournment. Shortly after two o'clock, they will partake of luncheon together in the Herbert Hall in the Exhibition, by invitation of the Chairman and Directors of the Alliance and Dublin Consumers' Gas Company. In the evening, at half-past eight, a lecture on "The Use of Gas from a Hygienic Standpoint" will be delivered by Professor Vivian B. Lewes, F.I.C., F.C.S., in the Lecture Theatre of the Royal Dublin Society, to which ladies are invited.

On the third day, the chair will be taken at ten o'clock; and the remainder of the technical business will be first disposed of. Then the names of the President and office-bearers for the ensuing year will be announced; three honorary members (the President of the Société Technique, and Professors Harold B. Dixon, F.R.S., and Arthur Smithells, F.R.S.), as well as ordinary members and associates, will be elected; the place for holding the next meeting determined upon; and the customary votes of thanks passed. In the afternoon, alternative visits may be paid to the brewery of Messrs. Guinness or to the locomotive works of the Great Southern and Western Railway Company. In the evening, by invitation of the President and Mrs. Hunt, a reception will be held at the Mansion House, kindly lent for the occasion by the Right Hon. the Lord Mayor. After the reception, there will be a concert and dancing.

Arrangements have been made for alternative excursions for Friday, the 21st, and for the week-end for those who can spare the time. The last will be to Killarney, where Saturday will be spent in visiting the Gap of Dunloe and in making the tour of the lakes, returning the following Monday. The excursions for Friday are to Glendalough, *viâ* Devil's Glen, or to Powerscourt Demesne and Waterfall and the Dargle Glen.

Annual Report of the Council.

The Council present the following as their report on the position and work of the Institution during the past year.

Membership.—The number of members at the end of the year 1906 was 799, as compared with 812 at the end of the previous year. The diminution of 13 is accounted for to a great extent by the comparatively large number of names which have been erased from the roll for non-payment of subscription.

It will be noticed from the figures below that during the year eleven members and five associate members (two of whom were formerly students) have been elected, and five students admitted. Three associate members have been transferred to the class of member. It may be added that considerably fewer elections have to be recorded this year than last; the reason being that, as the immediate result of the affiliation of six District Associations, 63 names were added to the roll during the year 1905.

The Council have pleasure in announcing that they have nominated for election at the forthcoming annual general meeting, as honorary members, Professor Harold B. Dixon, F.R.S., and Professor Arthur Smithells, F.R.S., Professors of Chemistry in the Victoria University of Manchester and in the University of Leeds respectively.

Class of Member.	At Dec. 31, 1905.	Elected and Transferred during 1906.	Deceased, Transferred, and Erased during 1906.	At Dec. 31, 1906.	Decrease.
Honorary members .	23	..	..	23	..
Members	679	11	21	669	10
Associate members .	98	5	8	95	3
Students	12	5	5	12	..
Totals	812	21	34	799	13

The Council have to announce with regret the decease of the following members since the publication of the last report:—

Eugene Lebon	Paris.
Magnus Ohren	London.
James Henry Parsons	Oswestry.
Joseph Reeves	Bilston.
William Sugg	London.
James Wadeson	Windsor.
Charles West	London.
William Winstanley	Newcastle-under-Lyme.

Annual General Meeting.—The annual general meeting of 1906 was held from the 19th to the 21st of June, at the Institution of Mechanical Engineers, Westminster, under the presidency of Mr. Charles Wood, of Bradford, the list of papers submitted being as follows. With the object of ensuring adequate time for the discussions, the lecture, which is usually a feature of the programme, was omitted on this occasion.

"The Fiddes-Aldridge Stoking Machinery at Wavertree Works, Liverpool." By Mr. Edward Allen, of Liverpool.

"Associated Management of Gas Undertakings." By Mr. R. B Anderson, of Westminster.

"Notes on the Argand Burner." By Mr. Charles Carpenter, of London.

"The Legal Relations Existing Between Road Authorities and Gas Undertakings." By Mr. Francis T. Cotton, of Dublin.

"The Retorting or Carbonization of Coal." By Mr. Thomas Glover, of Norwich.

"The Vertical Retort from a Practical Point of View." By Mr. Ernest Körting, of Berlin.

"Carburetted Water Gas for Smaller Gas Undertakings." By Mr. John Lyne, of Wexford.

The Council have awarded the London Gold Medal to Mr. Ernest Körting, for his paper entitled "The Vertical Retort from a Practical Point of View;" the Institution Silver Medal to Mr. Charles Carpenter, of London, for his paper on "Notes on the Argand Burner;" and the Institution Bronze Medal to Mr. Thomas Glover, of Norwich, for his contribution on "The Retorting or Carbonization of Coal."

By the courtesy of the respective Directors, the works of the Gaslight and Coke Company, the South Metropolitan Gas Company, and the Commercial Gas Company were opened to the members during the week of the meeting.

On the Wednesday evening, a reception was given by the President and Mrs. Wood at the galleries of the Royal Institute of Painters in Water Colours; and on the Friday an excursion was made to Boulogne—the Mayor and Mayoress (M. and Mme. Peron) welcoming the party on landing. By the kind invitation of the Directors of the European Gas Company, the members were enabled in the afternoon to make an inspection of their works at Boulogne.

Amendment of Conferences Act.—The Council regret that, notwithstanding the steps that have been taken during the past year with the object of obtaining such an amendment of the Public Health and Local Government Conferences Act of 1885 as would leagalize payment of the expenses incurred by members in the service of local authorities in attending the meetings of the Institution, no definite progress in the matter can be reported. Further action recently decided upon by the Council is being proceeded with, which it is hoped may result in the Institution's representations on the subject being brought under the notice of the Local Government Board.

International Committee on Photometry.—On the recommendation of the British representatives serving on this Committee (Mr. Charles Carpenter, Mr. James W. Helps, Professor Vivian B. Lewes, and Mr. T. O. Paterson), the Council have had printed and published in the Transactions of the Institution for 1906, a translation of the report of the Committee's first session, which took place at Zurich in June, 1903. Another session is to be held there in July next, which the Council have appointed Mr. Charles Carpenter and Mr. James W. Helps to attend as representatives of the Institution.

Reduced Railway Fares.—After repeated endeavours to induce the Railway Companies to concede reduced fares to members attending the Institution's meetings, the Council have at last succeeded in securing from the Associated Railways the privilege of the issue of return tickets at the rate of fare and a quarter; but as its continuation will depend on the number who avail themselves of it in connection with the Dublin meeting, it is essential that all who attend should if possible obtain their tickets by means of the Institution voucher.

District Members of Council.—The District Associations which are affiliated with the Institution appointed the following members as their representatives on the Council during the past year:—

Eastern Counties Association .	Mr. E. J. Brockway.
Irish Association	Mr. Geo. Airth.
Manchester District Institution .	Mr. Wm. Prince.
Midland Association	Mr. F. W. Stevenson.
North of England Association .	Mr. M. Leaf.
Southern District Association .	Mr. F. W. Cross.

Examinations in Gas Engineering and Supply.—The following suggestions, communicated to the Council by the Examiner (Mr. A. F. Browne), received their unanimous approval, and were conveyed to the Board of Examinations with the recommendation that they should be adopted by the Technology Committee of the City and Guilds of London Institute:—

> That co-operation between the Department of Technology and the Council of the Institution of Gas Engineers, and the employment of advisory or consultative methods, would probably result in arrangements regarding such questions as the number of grades, the scope of the syllabuses, the duration of the course of instruction, the appointment of examiners, &c., as would not only be mutually satisfactory, but would also be pleasing and reassuring to all concerned in the work of the examinations.

A favourable reply was received from the Institute, together with the request that the Council should, in conjunction with the Examiner, revise the present syllabuses. The matter was therefore referred to an Advisory Committee, consisting of the President (Mr. Charles Hunt), the Vice-Presidents (Mr. W. Doig Gibb and Mr. Thomas Glover), the Hon. Secretary (Mr. James W. Helps), and Mr. J. H. Brearley, Mr. Charles Carpenter, Mr. A. F. Browne (Examiner), Dr. H. G. Colman (ex-Examiner), Mr. S. Y. Shoubridge, and Mr. Charles Wood.

On the recommendation of this Committee, the Council adopted the following resolution:—

> The Council of the Institution of Gas Engineers are of opinion that while an examination in "Gas Engineering and Manufacture" should include distribution as heretofore, it is highly desirable, having regard to the great developments which have taken place during recent years in the application of gas, that there should be a separate examination in "Gas Distribution," and that the Committee of the Department of Technology of the City and Guilds of London Institute be therefore asked to allow a new examination to be added to the syllabus, under the title of "Gas: Its Distribution and Applications," and to modify the title of the existing examination to "Gas Engineering and Manufacture." That the draft syllabuses attached hereto and lists of works of reference with respect to the two new proposed examinations are unanimously recommended by the Council for the consideration and approval of the City and Guilds of London Institute.

The Board of the Institute have approved the syllabuses and lists of works of reference [see Appendix], and have decided that the examinations shall be entitled "Gas Engineering" and "Gas Supply."

Mr. Browne having informed the Board of the Institute that he could not undertake to act as Examiner in the new examination, the Council, on the invitation of the Board, nominated, as an additional Examiner, Mr. J. H. Brearley, of Longwood, who has kindly consented to act, and whose appointment has been approved. The first examination under the revised and new syllabuses will take place next year.

Amendment of the Gas-Works Clauses Acts.—As referred to in the Council's last report, the Parliamentary Committee have had under consideration the question of the expediency of taking steps for obtaining an amendment of the Gas-Works Clauses Acts. The following report of the Committee was received, and the recommendation contained in it has been unanimously adopted by the Council:—

> The Parliamentary Committee report that they have at several meetings had under consideration the proposed amendment of the Gas-Works Clauses Acts. In the drafting of clauses they have had the able assistance of Mr. C. E. C. Browne, of the firm of Messrs. Dyson and Co., Parliamentary Agents, and with regard to the form of accounts, that of Messrs. Wood, Drew, and Co. After going very carefully into the matter, and finding that such amendments as could be proposed would only consist of model clauses, and having ascertained also the view likely to be taken by the Board of Trade on the subject, they have unanimously—although with considerable regret—decided to recommend to the Council not to proceed further in the matter.

Special Purposes Fund.—The circular, copy of which appeared in the Council's last report, and which was issued on May 28, 1906, to all gas undertakings in the United Kingdom appealing for subscriptions to this fund, has resulted for the year ended Dec. 31, in the sum of £566 17s. 9d. being received from 145 undertakings,* and promises of further contributions amounting to £50 7s. 6d. have been received from seven others.

It was not possible for the Council to make a commencement upon any work of investigation until the extent of financial support was known, although for some time they have had under consideration important subjects needing treatment. They are now able to announce that two investigations are being proceeded with: (1) "The Various Methods of Carbonizing," and (2) "The Economical Application of Gas for Heating Purposes." To carry out this work, the Special Purposes Committee has been enlarged, and is now constituted as follows: The President of the Institution (Mr. Charles Hunt), the Vice-Presidents (Messrs. W. Doig Gibb and Thomas Glover), the Hon. Secretary (Mr. James W. Helps), and Messrs. Edward Allen, John Bond, J. H. Brearley, J. Ferguson Bell, A. E. Broadberry, Charles Carpenter, T. H. Duxbury, Thomas Goulden, W. R. Herring, W. Langford, S. Meunier, S. Y. Shoubridge, Alex. Wilson, and Charles Wood.

From this Committee two Sub-Committees have been formed, one consisting of Messrs. A. E. Broadberry, Charles Carpenter, Thomas Glover, and S. Y. Shoubridge, to consider the question of carbonizing; and the other consisting of Messrs. John Bond, J. H. Brearley, and Charles Wood, to treat of the application of gas for heating purposes. With the latter Sub-Committee it is hoped to secure the co-operation of Professors Smithells, Bone, and Cohen, of Leeds University. Both Sub-Committees will report from time to time to the Special Purposes Committee.

In regard to the Carbonizing Sub-Committee, it may be stated that a circular was issued on March 18, to all the members of the Institution, asking for any instances of exceptional results worthy of consideration which had come under their notice, and inviting the hearty co-operation of all in obtaining information which may be of value to the gas industry as a whole. The Sub-Committee, with the particulars furnished by the replies received to the circular before them, are now taking action.

With reference to the investigation into the economical application of gas for heating purposes, in order that adequate facilities could be obtained for carrying out the special experiments, tests, &c., required, in a satisfactory manner, the Council, after consultation with Professor Smithells, offered to establish at the University of Leeds an Institution Fellowship in "Gaseous Fuel," under Professor Bone, of the value of £100 per annum, and to meet the incidental expenses in connection therewith. The offer has been accepted by the Senate of the University, and steps are being taken to give immediate effect to the arrangement.

Standard Clauses in Contract Specifications.—By the desire of the Society of British Gas Industries, a conference was held between representatives of that body and of the Council to consider suggestions made by the Society as to the desirability of inserting certain standard clauses and general conditions in specifications for gas-works plant. The Council, having carefully considered the suggestions put forward, and having ascertained that it is not the custom of the Council of the Institution of Civil Engineers to suggest to its members any particular form of contract clauses, decided that it is not advisable to take steps in the direction desired by the Society.

Sales of Gas Acts.—At the request of the Council, the Parliamentary Committee have had under consideration the report presented by the Public Control Committee of the London County Council, containing the following recommendation of that Committee on the subject of gas-meter testing:—

> That the attention of the Board of Trade be called to the serious defects in the Sale of Gas Act, 1859, and that the Board be asked to introduce an amending Bill in the next session of Parliament, with a view to remedying these defects, and to obtaining such amendments of the existing law as the experience of the Council has shown to be desirable.

A circular asking for an expression of opinion on the proposals contained in the report was issued to all the members of the Institution. The replies received were considered by the Parliamentary Committee in conjunction with representatives of meter manufacturers, who, through the Society of British Gas Industries, were invited to attend a conference for the purpose. In accordance with the decision then arrived at, a letter was addressed to the Standards Department of the Board of Trade, conveying the request that, in the event of any amendment of the Act being contemplated, opportunity should be given for the Institution to express its view upon it.

The reply received from the Board was as follows:—

> *Board of Trade (Standards Department),*
> *Old Palace Yard, S.W., April 10, 1907.*
>
> Sir,—I have to acknowledge your letter of the 8th inst. with reference to certain proposals for the amendment of the Sale of Gas Act, 1859, and to inform you that in the event of any such amendment being determined on your communication will be borne in mind.
>
> (Signed) R. A. MacMahon,
> Deputy-Warden of the Standards.

Library.—The list of the books which have been presented to the library during the past year is appended, and the Council desire to record their thanks for them. It has been decided to print and publish with the next volume of Transactions a complete catalogue of the contents of the Institution's library, so that the loan of books to members desiring to borrow may be facilitated.

Engineering and Machinery Exhibition, 1907.—From Sept. 19 to Oct. 19 next, an Engineering and Machinery Exhibition is to be held at Olympia, under the presidency of Sir A. B. W. Kennedy. With the Presidents of other technical bodies, the President of the Institution, Mr. Charles Hunt, has consented to act as Patron, and Mr. James W. Helps and Mr. Daniel Irving to represent the Institution on the Honorary Advisory Council of the exhibition.

Sir William Perkin's Jubilee.—In accordance with the announcement contained in the Council's last report, the address congratulating Sir William Perkin on the occasion of the celebration of the "Jubilee of the Coal-Tar Colour Industry" was handed to

* These are enumerated in a list appended to the report.

Sir William by Mr. James W. Helps, at the special meeting held at the Royal Institution on July 26, 1906, when delegates representing numerous scientific societies at home and abroad also attended to present their congratulations. The address from the Institution was in the following terms:—

To William Henry Perkin, LL.D., Ph.D., D.Sc., F.R.S.

The President, Council, and Members of the Institution of Gas Engineers desire to join in offering to you their hearty congratulations on this the occasion of the celebration of the fiftieth anniversary of your discovery of the first coal-tar colouring matter, mauve—a discovery which has exerted a marked influence on chemical manufactures generally, and is of special interest to all associated with the gas industry.

They recall with pleasure the fact that the Institution has already expressed its indebtedness to yourself by enrolling your name on the list of those to whom its Birmingham Medal has been awarded for originality in connection with the manufacture and application of gas, interpreted in its widest possible sense.

They trust that many years of health are still before you to enable you to continue the work of scientific investigation to which your life has been so usefully devoted.

Accounts.—The balance-sheet and accounts for the year ended Dec. 31, 1906, are duly certified by the appointed Auditors, Mr. J. L. Chapman, and Messrs. Wood, Drew, and Co.

CHAS. HUNT, President.
WALTER T. DUNN, Secretary.

[APPENDIX.]

The following are the syllabuses for the examinations by the City and Guilds of London Institute in "Gas Engineering" and "Gas Supply" referred to in the preceding report.

GAS ENGINEERING.

The examination will include questions founded on such subjects as the following:—

ORDINARY GRADE.

1.—The construction and setting of retorts for the destructive distillation of coal, and the furnaces or producers for heating them.

2.—The methods of charging and discharging retorts, and the machine and other tools employed; the fittings of the retort-bench, including the hydraulic (or dry) main.

3.—The effects of modifications of carbonizing temperature upon the quantity and quality of gas yielded by the coal.

4.—The description of apparatus for the manufacture of water gas (uncarburetted or carburetted), and the practical working of the plant.

5.—The principles and methods of gas condensation, with descriptions of apparatus employed.

6.—The exhauster—its construction, its use or object, and the means by which it is actuated and controlled.

7.—The methods of removing the gaseous impurities present in the gas after condensation, together with the apparatus and materials employed. The chemical reactions involved.

8.—The various instruments used in gas-works for ascertaining and recording pressure and exhaust, and their practical employment and significance.

9.—Usual methods and apparatus employed for testing coal gas, water gas, producer gas, waste gas, &c., including the usual tests for illuminating power, calorific value, specific gravity, and purity of the gas supplied to the public, and those for ascertaining the value of the bye-products.

10.—The simpler physical and chemical principles involved in the ordinary processes of gas manufacture and the formation of the bye-products.

11.—The general principles involved in the construction of the gas-holder and its tank. The advantages of the holder in gas distribution. The laying of mains and services. The necessary methods for securing an adequate supply of gas throughout the area of a district. The methods and instruments employed at the works for the due control of the pressure in the street mains.

12.—The fitting up of premises for the supply of gas for light, heat, and power. The construction, testing, and fixing of gas-meters. The influence of temperature and pressure on the volume of gas.

13.—The construction of various types of gas-burners. The simpler physical and chemical principles involved in the combustion of gas The economy and efficiency of incandescent lighting as contrasted with luminous flames. High-pressure lighting.

HONOURS GRADE.

In the Honours examination more difficult questions will be set in the subjects named in the syllabus of the Ordinary Grade, and, in addition, a knowledge will be required of—

1.—The characteristic properties of the various kinds of coal, and their value for gas-making purposes.

2.—The effects of temperature upon the production of residuals.

3.—Chemical composition and physical properties of coal gas, and the influence of each component upon the illuminating power and calorific value of the gas.

4.—The principles of combustion, and their application to the working of retort-furnaces.

5.—The more advanced physical and chemical principles involved in the processes of destructive distillation of coal, and in the condensation and purification of the resulting gas.

6.—The methods of complete gas analysis, including those for ascertaining the amount of impurities in the crude gas. Method of testing oil to be used in the manufacture of carburetted water gas.

7.—Theory and practice of photometry, calorimetry, and pyrometry. Full details of apparatus employed.

8.—Gas lighting. High and low grade gases. Illuminating power. Flame temperature. Specific heats. Air supply. Incandescent lighting theory and practice. Intensified lighting. Burners and apparatus.

9.—Application of power and labour-saving appliances in gas-works.

10.—The construction of gas-works plant generally.

11.—The management of the various portions of the plant in order to obtain the best efficiency of the apparatus, with due regard to economy in working.

12.—The method of dealing with such emergencies as are of more common occurrence in gas-works through breakdown of machinery or other failure of plant.

13.—Working up of ammoniacal liquor and treatment of waste products.

14.—Gas in competition for light, heat, and power.

15.—The construction, working, and efficiency of the gas-engine.

16.—Flow of gas in mains, theory and practice. High-pressure distribution.

17.—Structural capacity. Working costs.

18.—Such important recent developments of the gas industry as have been fully described in the Technical Press.

[Here follows the list of works of reference.]

GAS SUPPLY.

The examinations will include questions founded on such subjects as the following:—

ORDINARY GRADE.

1. *Mains and Services.*—Station and district governors. General principles of distribution. The various kinds of pipes and fittings used, and testing of same. Methods of laying. Joints and jointing. Maintaining supply during alterations to existing mains and services. Causes of corrosion and preventives. Unaccounted-for gas. Leakage, causes of and testing for. Syphons. Valves. Pressure-gauges. Maintenance.

2. *Gas-Meters.*—Principles and construction of gas-meters, including slot and stop mechanism. Repairing, testing, and fixing of meters.

3. *Plumbing.*—Properties and composition of various alloys, such as brass, gun-metal, &c., used for valves, cocks, gas-fittings, &c. Solders, their composition, preparation, and uses. Methods of soldering.

4. *Interior Fittings.*—Description and size of pipes in relation to requirements. Distribution of light. Testing of installations. Anti-vibrators. Moveable pendants. Other fittings and accessories. Simple principles of ventilation. Method of governing pressure beyond the meter.

5. *Luminous and Bunsen Flames.*—Theory and application of.

6. *General Lighting.*—Construction of flat-flame, argand, regenerative, and incandescent burners. Regulation of gas and air supply to burners. Causes and prevention of mantle breakages. Influence of shades, globes, wall-papers, &c., on light efficiency.

7. *Outside Shop and Street Lighting.*—Types and construction of lanterns. Principles of windproof lanterns. Suspension brackets and lamp-pillars.

8. *Use of Gas for Heating Purposes.*—Construction, types, and fixing of cookers, boilers, fires, irons, &c. Hot-water circulating appliances. Geysers. Flues for waste products.

9. *Gas Power.*—Construction and practice of the gas-engine.

10. *Tools and Appliances.*—A full knowledge must be obtained of all the tools and appliances necessary for repair and extensions from the works' governors to the point of combustion.

HONOURS GRADE.

In the Honours examinations more difficult questions will be set in the subjects named in the syllabus of the Ordinary Grade, and, in addition, a knowledge will be required of—

1. *Mains and Services.*—Flow of gas in mains, theory and practice. Comparative advantages of wrought-iron, cast-iron and steel. Various methods of jointing. Electrolysis and electric fusion. Methods of dealing with naphthalene and other stoppages. Pressures and pressure-recording instruments. Main-laying costs and relation to prospective income. First aid in cases of "gassing." High-pressure distribution. Fans, blowers, and compressors. Subways, advantages and disadvantages of. The carrying of mains over bridges, and under rivers and canals. Explosive mixtures.

2. *Interior Fittings.*—Specifications. Principles and construction of various types of burners and plant for intensified lighting. Lighting of churches, factories, and other large buildings. Theory and practice of ventilation by gas. Lighting for special purposes, such as billiard-tables, &c. Switch lighting.

3. *General Lighting.*—Efficiency of flat-flame, incandescent, and other burners. Low and high pressure lighting. Theory, manufacture, composition, and testing of the incandescent mantle. Illuminating effect of different methods of lighting. Flame temperature. Air supply. The hygiene of gas.

4. *Outside Shop and Street Lighting.*—Public lighting. Testing for illuminating power and illuminating effect. Influence of reflection. Advertising and illuminating devices. Automatic lamp-lighting appliances.

5. *Gas used for Heating Purposes.*—Industrial and domestic uses of gas. Testing and heating appliances. Influence of air supply and flame temperature.

6. *Gas Power.*—Calorific power. Comparative costs and thermal and mechanical efficiencies of the gas-engine, and competing power agents. Gas-driven electricity plants.

7. *Gas* in competition for light, heat, and power, and the chief legal obligations affecting gas supply.

8. *Such important recent developments* in any of the foregoing subjects as have been fully described in the Technical Press.

The examination in both grades will be held on Saturday, May 9, 2.30—6.30 p.m. The fee for the examination in either grade is one shilling and sixpence.

[Here follows the list of works of reference.]

Mr. W. E. Chambers, who was for some time the Chairman of the Sutton District Water Company, left estate of the value of £28,833.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Leek.

An early start was arranged for from Manchester on Saturday (and an even earlier one for the Yorkshire members), on the occasion of the one-hundred-and-fiftieth quarterly meeting of the Manchester District Institution of Gas Engineers; and the full programme mapped out by the President (Mr. William Prince, of Stoke-on-Trent) assisted by Mr. H. Kendrick, the Honorary Secretary, kept every hour of the day fully occupied till the time arranged for leaving Leek about half-past six in the evening.

The gas-works belonging to the Leek Urban District Council are situated close against the railway station, and they formed the first object of interest on the arrival of the party. The Manager of the works (Mr. A. A. T. Botteley) had thoughtfully prepared a tastily-arranged illustrated "Souvenir" of the visit—containing photographs of the works and notable places about the town. It also gave an account of the origin and progress of the Leek Gas-Works from 1826 to the present time, from which some interesting particulars may be extracted.

In the spring of 1826, a Joint-Stock Company issued a scheme for raising £5000 by the issue of 200 shares of £25 each. These were all subscribed for, except two; and the capital was called up as the building of the works proceeded. In 1828, the town was first lighted with gas. In 1830, the capital had all been subscribed and expended; and £1 per share more was required to complete the works to their then extent. The profits on the gas manufactured to that time had also been expended on extending the works. The shareholders received no dividend until the commencement of 1832, and then only 10s. per share. At the end of 1832, a dividend of 12s. 6d. per share was declared. In 1833, no dividend was paid. In 1834, £1 per share was declared. Afterwards they were paid £1 5s. per share.

The price of gas for some years was 12s. 6d. per 1000 cubic feet, which (however exorbitant it may seem at the present time) was less than was being paid at Manchester at the same period. By a printed report of the Police Commissioners of that place, it appears that the price of gas was 14s. in 1828, and 10s. in 1835. The use of gas was then becoming general; and the effect which reductions had from time to time became apparent from the introduction of gas, not only into manufactories and shops, but into private houses. But with the larger sales, and frequent reductions in price, the profits were not diminished, but were rather increased.

In the year 1845, the Leek Town Commissioners purchased the works for £6194, including legal expenses. The make of gas about this time was 1,500,000 cubic feet. They were much censured at the time by many of the inhabitants. But they had great confidence that the purchase would in a few years prove a beneficial one for the ratepayers; and the results show that they have not been disappointed.

In 1848, the price of gas was reduced from 9s. 6d. to 8s. 6d. per 1000 cubic feet; in 1850, to 7s. 6d.; in 1852, to 7s.; and in 1855, to 6s., with a graduated discount when the consumption reached certain quantities. A table appended to the "Souvenir" showed the progress of the sales and price of gas from 1856 to the present time. From this it appears that (taking five-year periods) the make of gas was: In 1880, 32,836,000 cubic feet; in 1885, 40,314,000 cubic feet; 1890, 49,838,000 cubic feet; in 1895, 60,105,000 cubic feet; in 1900, 77,221,000 cubic feet; in 1905, 100,104,000 cubic feet; while to March 31 this year, the make was 105,710,000 cubic feet. From 1885 to 1895 the price of gas was 2s. 5d. per 1000 cubic feet; then 2s. 3d. for five years; 2s. 10d. in 1901 and 1902; and 2s. 7d., 2s. 5d., 2s. 5d., 2s. 3d., 2s. 3d. the last five years. The number of consumers in 1885 was 1510; in 1900, 2450; in 1905, 3070; and now, 3837—the rental advancing during the same period from £5161 to £13,381.

At the present time the works consist of an up-to-date plant. The retort-house, which has been extended during the past year, now contains eight beds of inclined retorts, eight retorts in a bed; the length of retorts being 20 feet, and capable of carbonizing 80 tons of coal per 24 hours when all are in use. The reserve is now ample; the maximum daily delivery being about 600,000 cubic feet. The retort-house is substantial, roomy, and well ventilated—there being especially plenty of head-room in the coke-cellar. The condensers are capable of passing a million cubic feet of gas per 24 hours; as also is the tower scrubber.

There are two exhausters, one dealing with 15,000 and the other 40,000 cubic feet per hour. The purifiers are of the rubber-sealed type, consisting of four boxes, 30 feet by 30 feet. They are filled and emptied by means of a half-ton bucket running on a centre girder the length of the house. It is worth recording here that the rubber-sheeting used for the sealing of the purifier lids has not been changed since 1900, and still seems good for use for a long time to come.

At the present time a coal-conveying plant is in course of completion. It will deal with the coal direct from the trucks, and is capable of handling 30 tons per hour. The works are considerably higher than the railway sidings, and divided from them by the main road. Under the new system, the waggons will be run on to a weighbridge and then tipped up; the contents being shot through the end door into a hopper passing through a coal-breaker and deposited on an endless belt which travels at an angle of 23 degrees through a tunnel under the road to the roof of the coal-store, where the coal is to be deposited immediately above the bucket elevator which feeds the inclined retort conveyor. The plant will be driven by a gas-engine.

The present area of gas supply in Leek has recently been much increased, so as to include the villages of Longsdon and Rudyard. The latter place will be supplied shortly with gas which will be governed and metered at the works, and sent through a 5-inch steel tube for a couple of miles along the North Staffordshire Railway to Rudyard Station, from which point cast-iron mains will be laid through the village and district.

After an inspection of the works, the members were driven to the Council's electricity station, the notable feature of which is that the whole of the current is generated by gas-engines—the last erected being a 220 B.H.P. Campbell engine coupled direct to a 125 kilowatt dynamo. All the gas used is metered, and is paid for at the wholesale rate of 1s. 6½d. per 1000 cubic feet.

Luncheon was the next item on the programme, to which the members were invited by the Chairman and members of the Urban District Council. At its conclusion,

The toast of "The King" was given by Mr. H. ALLEN, J.P., the Chairman of the Urban District Council.

Mr. T. H. BOOTH, the Chairman of the Gas Committee, proposed "The Manchester District Institution of Gas Engineers;" coupling with it the name of Mr. Brearley. Referring to the Leek Gas-Works, he said that nine years ago they were altogether too small. The retorts and settings were tumbling down; and the Committee had to consider what to do. They agreed to go in for the newest and very best system obtainable; and in order to accomplish their object, they took the advice of Mr. Thomas Newbigging, of Manchester, who recommended regenerators. They would not, he thought, require any further extension of the works for ten years at least.

Mr. J. H. BREARLEY (Longwood), in response, said the gas-works gave evidence of a progressive Gas Committee and an eminent Engineer. He was sure the Leek Gas Committee would treasure the work that Mr. Botteley had carried out while in their employ.

Mr. W. PRINCE (Stoke-on-Trent), in giving the toast of "The Leek Urban District Council," said the members of the Institution deeply appreciated the kind welcome given them that day by the Council. They had greatly enjoyed the visit, and would go home feeling that they had seen a thoroughly equipped plant which was a credit to the Gas Committee and their Engineer. The Leek Council must have been blessed with forefathers who had a wonderfully keen conception, because now they were in the enviable and unique position of standing with a capital of only £3 per million cubic feet of gas manufactured. With regard to the price charged for gas in Leek, it had been his sorry lot be a neighbour of Mr. Botteley, who could sell gas at 2s. 3d. per 1000 cubic feet, while much larger concerns had to draw from their consumers something like 3s. Then, again, in Leek they had had the "audacity" to sell coke at 4d. per cwt., which was all very well for the consumers, but rough on their neighbours. No doubt now, owing to the extension of the works and the price of coal, the charge for coke would be slightly increased. Yet the people of Leek had had a very good innings; and he for one was glad to find that they would now have to come more into line with their neighbour. He coupled with the toast the names of Mr. Moore, the ex-Chairman of the Council, and Mr. Ingram.

Mr. MOORE, in responding, said the Leek Council were in the happy position of having their own water, gas, and electrical undertakings; and if anything else came up, they would take that on also. They did not want their markets to be under any one else's superintendence. They did not want to overcharge themselves for their gas and their residuals; but he thought they had erred on the side of charging too little, and consumers ought not to grumble if the price was now raised slightly to meet a slight deficit.

Mr. INGRAM also briefly returned thanks.

After the luncheon, the members proceeded to the Town Hall, where the business meeting was to be held. The PRESIDENT (Mr. W. Prince, of Stoke-on-Trent) took the chair.

The minutes of the previous meeting were taken as read.

LETTERS OF APOLOGY.

The HON. SECRETARY (Mr. H. Kendrick) stated that he had received letters of apology from 68 members and friends, including Mr. Charles Hunt, the President of the Institution of Gas Engineers, who stated that he regretted his inability to be present, more especially in view of the interesting paper which was going to be read by Messrs. Clayton and Skirrow, a copy of which had been sent to him.

VOTE OF THANKS.

The PRESIDENT, on behalf of the members, tendered the thanks of the Institution to the Chairman and the Urban District Council for the honour conferred on them that day.

Mr. H. ALLEN said he considered that a great compliment had been paid to the town by the visit of the Institution, and he hoped it would be repeated.

LETTERS OF THANKS FOR SYMPATHY.

The HON. SECRETARY stated that a letter had been received from Mr. and Mrs. Frankenberg, of Salford, expressing their

thanks to the members of the Institution for their kind and thoughtful sympathy with them in their recent bereavement, when they lost one of their sons on the *Berlin*. A letter had also been received from Mr. Robert Watson, of Doncaster, who had lost a brother on the same vessel, tendering his thanks to the members for their sympathy.

The Institution of Gas Engineers.

The Hon. Secretary stated that a letter had been received from Mr. Dunn, acknowledging the receipt of the nomination of Mr. John Wilkinson, of Halifax, as the representative of the Manchester District Institution on the Council of that body. No doubt those members who were also members of the Institution of Gas Engineers would have received their voting papers, from which they would have observed that the President had been nominated for one of the vacancies, and also one of their friends and near neighbours, Mr. John Young, of Hull. It was anticipated that all the members of the Institution would vote for their President, at all events.

Reading of Papers.

The reading of the two papers prepared for the meeting—viz., "Purification," by Mr. G. H. Niven, of Cleckheaton, and "The Estimation of Tar Fog and its Separation from Gases," by Messrs. R. H. Clayton, B.Sc., and F. W. Skirrow, Ph.D.—was then proceeded with [see pp. 658 and 660]; and, on the proposition of the President, it was agreed by the members to discuss them together.

At the conclusion of the meeting, the members proceeded by coaches to Rudyard, where tea was served at the hotel.

MIDLAND JUNIOR GAS ASSOCIATION.

Visit to the Works of Messrs. George K. Harrison, Limited.

On Saturday, between thirty and forty members of the Midland Junior Gas Engineering Association, undeterred by the not very promising weather conditions, took advantage of the invitation of Mr. J. A. Mobberley, the Managing-Director of Messrs. George K. Harrison, Limited, to inspect their fire-clay and brick works; and they were amply rewarded, for the visit combined both pleasure and instruction.

The firm have works at Lye, Brettell Lane, and Nagersfield (all containing seams of Stourbridge clay, and having every facility for transport); but time only permitted of the last two being visited—the Lye works (the original seat of the firm's operations), which cover an area of 35 acres, and have been in use about a century, being omitted. It may be stated that from the pit at the Lye works, the fire-clay is conveyed along bogie-lines to the weathering ground, where it is eventually sorted by experienced men; the finer class being set aside in sheds for special purposes. A large, well-equipped double mill grinds, separately, the fine and coarse varieties of clay—the former to be used for retorts, crucibles, and other goods that have to stand intense heat, and the latter for bricks, lumps, &c. The ground clay from the mills is taken along the bogie-lines to the moulding floors. The numerous kilns, all of improved construction, are ranged around the drying floors. A special quality of silica fire-brick, calculated to resist the most intense heat and sudden changes of temperature, forms a notable production of the works. This material, when properly selected and worked, is said to be absolutely non-contractive.

On arrival, the party assembled at the Brettell Lane offices; the members of the firm who received them being Mr. William King Harrison, Mr. E. C. Harrison, and Mr. Mobberley. There were also present Mr. James England, the Cashier, and Mr. Owen Freeman, the Works Manager. A move was then made through the adjoining works, which cover a more extensive area than those at Lye, and are equipped with a large amount of special machinery and appliances, which were shown in operation—the whole process of manufacture being demonstrated. The fact that the works were left running during the inspection, of course, added vastly to the attractiveness of the visit; and the kindness shown in going to this trouble for the sake of the visitors, was warmly acknowledged on all hands. At these works, there is a 50-H.P. engine driving a powerful modern mill, grinding 100 tons per day, also a special machine for making hexagonal bricks for use in Cowper stoves. The capacity of this machine is 10 hexagons per minute; and there are presses for finishing them off. The haulage of goods between Brettell Lane and Nagersfield is now accomplished by means of an endless rope; the ropeway, having many awkward curves. Following along this, the party arrived at the Nagersfield works, which were opened some fifteen years ago, and are on a very large scale. Here were to be seen a 300-H.P. condensing engine driving two powerful grinding mills, brick-making machines, the endless rope of 2500 yards length for conveying coal and bricks to Brettell Lane, and a dynamo, generating electricity for lighting up all the works and mines, and also clearing the mines of water. There are 130-H.P. winding engines, working on first motion, which travel at a very great speed; and a 30-H.P. haulage engine for conveying the minerals from the workings to the pit bottom. The fitting shops are complete with lathes, drills, &c., so that any necessary repairs may be carried out by the staff. The area of the firm's property, minerals, &c., is about 500 acres; and is all freehold.

Passing on to the pit-head, a photographer who was in waiting called a halt for a brief space; and then a descent of the pit was made, and the visitors were taken in charge by Mr. W. Ivan Smith, the Mining Engineer, and by Mr. B. Fellows, the Underground Manager. Here, again, the thoughtfulness of Mr. Mobberley manifested itself; for when the working faces were reached, miners were found still busy with their picks. Electricity has been introduced into the mine, which, when one leaves the shaft, presents quite an inviting appearance. Another short pause having been made to allow the photographer once more to work his will (this time, of course, by the aid of a magnesium flash), the visitors were taken by their guides to see both the Old Mine and the New Mine seams; questions of all sorts being meanwhile answered almost before they were asked. It was stated that the distance walked (sometimes upright, and sometimes otherwise) during the underground inspection was about three miles; and certainly it seemed to be quite as much as this. Be that as it may, however, the hour and more spent in the mine proved most instructive; and so far from being anxious to reach the top again, most of the members stopped in their upward journey to have a glance at the coal seam which is being worked above the clay.

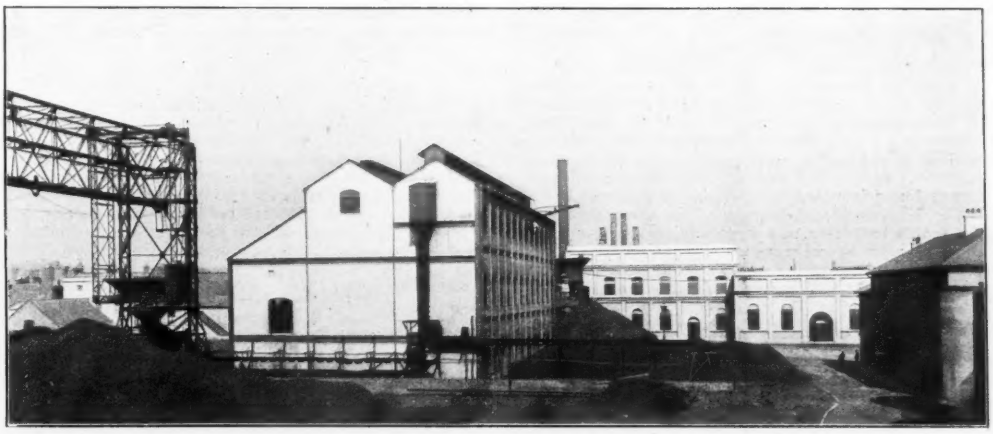
Returning to the offices, the visitors sat down to a meat tea, which their hosts had kindly provided for them, and to which their afternoon's exercise enabled them to do ample justice. Afterwards, Mr. S. T. Smith (Walsall), in the absence of Mr. G. W. G. Tatam, the President, proposed a hearty vote of thanks to Messrs. George K. Harrison for inviting them to visit their works that afternoon, and for their great hospitality. He was sure they were all indebted to Messrs. Harrison, Mr. Mobberley, Mr. Ivan Smith, and the other gentlemen, for not only explaining the making of the fire-bricks and retorts, but the getting of the clay out of the mines. The latter had been particularly instructive; for though they saw fire-bricks every day, and had some knowledge of how they were made, they did not know so much about the actual mining of the clay, and they could not learn without such invitations to go down a mine as they had received that day. He had no doubt they had learnt a good deal, both above and below ground. They had seen an up-to-date works, fully equipped with the most modern appliances, and had had explained to them the whole process of fire-brick making; and then in the mines they had had made clear to them the methods of getting the clay, and also the different qualities of the seams.

The proposal was seconded by Mr. F. J. Bywater (Birmingham), who added his tribute to what Mr. Smith had said with regard to the great kindness that had been shown them, and the highly instructive character of their visit. During recent years, he had seen many fire-clay works; and he must say that those they had just been over were one of the best, if not the best, he had inspected. They had had everything shown to them openly and straightforwardly—how the bricks, &c., were made from the very beginning. Therefore they had every cause to congratulate themselves. The subject of fire-bricks was a very intricate one; and they could not have too much instruction upon it, because they would never thoroughly understand it. It was not perfectly understood, even by those who had spent a lifetime on it.

The vote having been carried by acclamation, Mr. Mobberley returned thanks on behalf of the firm. He said it had been a very great pleasure to see the Association there that day and show them what the works were like. Gatherings such as that were, to his mind, very important to gas engineers, inasmuch as they enabled them to see what was the process of manufacture, as well as to become acquainted with the clay itself. That afternoon they had gone through the whole process. They had seen the clay in its natural state in the pit, how it was brought to the surface, weathered, and made into various articles. The firm had recently been modernizing all their plant; and he did not hesitate to say that in the near future they would be able to compete with any manufacturer. At the present time they were aiming at a very large output; and their four modern grinding mills had a capacity of 2000 tons per week. They had an idea of putting down a retort machine in the near future; and next time the Association visited the works, he hoped they would see it in operation. He was sorry there had not been an opportunity of inspecting the Lye works, inasmuch as there were arrangements there for turning out special goods which would have interested them. He hoped, however, at some future date to see the members again.

Mr. Ivan Smith expressed his pleasure at showing the visitors round the pit, and regretted that it was physically impossible for him to give them all personal attention, and to explain as he should have liked to have done the method of working the two seams they had visited. Those who were near him might perhaps have learnt a few little wrinkles about mining; and he would have been glad to have made clear to each one individually the very great differences that existed in the clay seams—not only in that part, but in the whole of the Stourbridge district—and in the methods of mining. He thanked them very much for the manner in which they had accorded the vote, with which his name was coupled.

THE SOUTHERN ASSOCIATION AT BOURNEMOUTH.



A General View of the New Gas-Works at Poole, of the Bournemouth Gas and Water Company.

A meeting can be a "record" one in more points than numbers. And in number of visitors and likewise in interest, the visit of the Southern Association of Gas Engineers and Managers to Bournemouth last Thursday was in truth a record one. Nothing less could have been expected, judged by the combination of attractions—Bournemouth, continous carbonization in vertical retorts, complete new gas-works, and a right hearty invitation from a Board of Directors who have a keen appreciation of the work of the technical men of the gas industry. The number of the members present was about ninety; and with the Chairman and Directors of the Bournemouth Gas and Water Company who were present—viz., Mr. G. Crispe Whiteley, Mr. R. Hesketh Jones, and Mr. Samuel L. Rymer (Mr. Corbet Woodall was unavoidably detained in town)—and members of the staff of their Engineer and General Manager (Mr. Harold W. Woodall, who is the President of the Association this year), the party numbered approximately 100. The Secretary of the Company (Mr. William Cash, F.C.A.) arrived from London later in the day. One notable feature was the excellent muster made by the South-West and Isle of Wight members, many of whom arrived betimes in the morning, were welcomed by the President at the Bourne Valley Works, and were given a long and good view of the installation of two settings of four vertical retorts, and an explanation of their working, before the more numerous contingent of members from London came upon the scene. The journey from town was made by the 10.15 train from Waterloo, to which special saloon carriages had been attached; and the visitors alighted at Branksome Station—the nearest to the Bourne Valley Works, to which they were not long in repairing. Among them was Sir George Livesey, who wished to see all the son of his old friend was doing at Bournemouth, in attempting to carve out, in association with Mr. A. M. Duckham, a special channel in the scientific and practical development of the work of gas manufacture, as well as to inspect the new works at Poole, for which Mr. Woodall has been responsible from plan to finish.

Continuous Carbonization in Vertical Retorts.

Of the settings of vertical retorts, the members made the most thorough inspection and inquiry that time and opportunity would permit; but the whole thing was so novel to many of them that they could only look on and admire the whole simplicity of the arrangement and operation which has been produced by the skill and patient perseverance of Messrs. Woodall and Duckham. A special article on the work that has been done at Bournemouth in this direction—tracing the steps that have led up to the present, and hinting at the hopes of the inventors for the future—is given in another part of this issue (pp. 638-41); and therefore there is no necessity to dwell further upon the subject here.

Hospitality—The Attitude of Boards of Directors and Gas Committees to their Officials.

By motor car and coach the visitors were, at the close of the inspection (which some found all too short, but the Hon. Secretary, Mr. A. F. Browne, was insistent on fidelity to tabled times), conveyed to the beautifully situated Canford Cliffs Hotel, where the Chairman and Directors of the Bournemouth Gas and Water Company entertained them to luncheon. The Chairman (Mr. Whiteley) presided; Sir George Livesey and Mr. Hesketh Jones were on his right hand side; and on his left were the President of the Association and Mr. Rymer.

After luncheon, there were the usual loyal toasts; and then other toasts were honoured, from the speeches accompanying which we wish to make some extracts, in view of the somewhat special character of this excursion meeting.

Sir George Livesey said he had the pleasant duty to perform of wishing "Prosperity to the Bournemouth Gas and Water Company." Wishing, he said, did not do much; but happily the Bournemouth Gas and Water Company had got past the necessity of good wishes so far as he could learn. (Laughter.) The Company were in an exceedingly prosperous condition; and they had the best hopes of those present for further prosperity. What the visitors had seen that day had shown how enterprising the Company were. They had seen what might be regarded as a comparatively new works, but were being superseded by other works in another place, where gas could be made more profitably and advantageously. He must couple the good wish with the names of the Chairman and Directors of the Bournemouth Gas Company, and of the Engineer and any other officers who might have assisted in bringing the Company to its present state of prosperity. The Engineer was the son of a very old friend of his (Sir George's); and he was pleased indeed to see he had succeeded, to an extent that had surprised him, in his experiment of carbonizing coal in vertical retorts. The machinery they had seen that day certainly did both him and Mr. Duckham great credit for ingenuity and adaptation. In further remarks, Sir George said that, so far as gas companies were concerned, they were in strenuous times. Things were not as they were. The position of a gas manager, engineer, or secretary of a gas company was not what it used to be. Unfortunately, they seemed to have very few friends. He did not know why this was so, because certainly there were very few men and very few industries that had done so much good, and had been so necessary and so beneficial to the community as the gas industry. It was the traditional policy of the gas industry everywhere to sell gas at as low a price as possible; but so far as one could see, the idea of the heads of other businesses was to extract as much as they could from their customers. The principle of the gas industry had been all over the country to sell gas at as low a price as was attainable; but the public and the authorities did not seem to believe it. It was evident that a good many people measured the corn of the gas industry by their own bushels; and they could not understand that gas men were animated by any right principles whatever. However, on this occasion, the thanks of those present were due to the Chairman and Directors for the gracious entertainment they had afforded their visitors, and for the intellectual and practical entertainment they had also given them.

The Chairman, in the course of his reply, said for the last twenty years he had occupied a position upon the Board of the Bournemouth Gas and Water Company; and, for the last ten of these years, it had also been his responsibility to direct, however imperfectly, from the chair its fortunes. But he confessed he had never had a more pleasing duty to perform than to welcome to Bournemouth, on behalf of his colleagues and himself and the shareholders generally, the Southern Association of Gas Engineers and Managers. Sir George Livesey had said some very kind and nice things about the Company. But he (the Chairman) asked those present not to imagine for a moment that he was going to take all those kind things to himself. He was heartily supported by colleagues, two of whom were present, but he regretted that Mr. Corbet Woodall could not possibly be with them. They, as a Board, were not going by any means to underrate the support or value of the services they obtained from their Engineer and Manager. They had been supported in the past as they were in the present by able and good officers; and so they had been able to attain the position which Sir George had been good enough to say they occupied in the gas world. He did not know whether at any of their meetings the Association had discussed the proper position of Boards of Directors: what they should do, and what they should not do; how far the chairman should interfere with the work of the engineer, and how far he should not do so. If they had discussed the subject, he was sure they had come to a right and proper conclusion. (Laughter.) He should like to emphasize this, that in the Association's choice of a President, the Board of the Company recognized to the full the endorsement of their own doing in the choice of an Engineer. Whatever might be the duties of the Board or of its Chairman, the one thing they had ever striven to do was to select good men; and when they had selected them, to give them their fullest confidence. That was what they had done in this instance; and in selecting as their Engineer a gentleman whom the members of the Association had elected as their President, he thought they showed that they were agreed all round, and that, at all events in Bournemouth, they had the right man in the right place. He did not say that, as a Board, they let their Engineer do everything he wanted to do. He did not know that it would be good for any man to have all his own

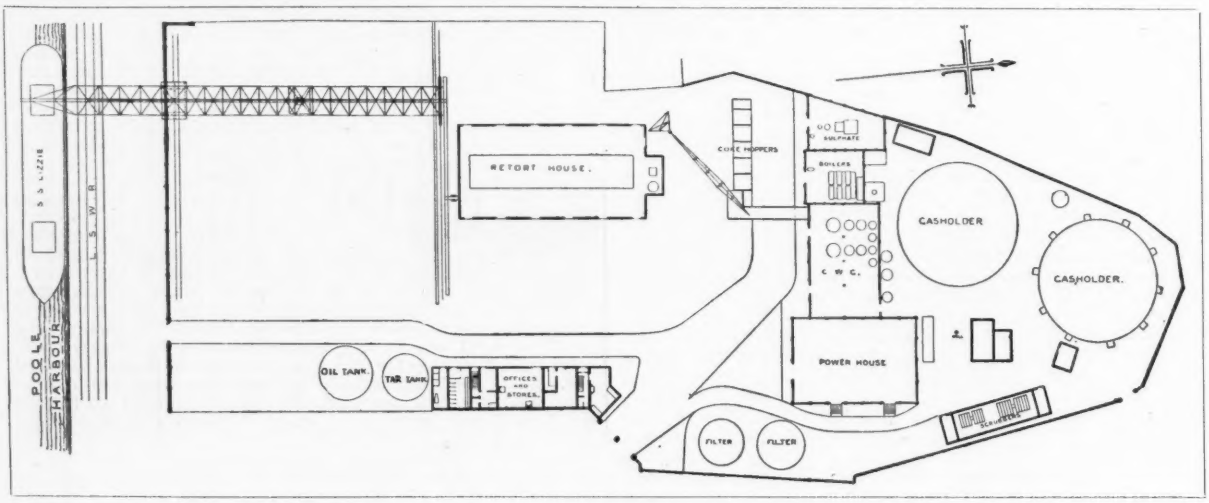
way. But they gave Mr. Woodall fair scope; and they were inclined to give him full scope—at all events ample opportunities to show his energy and enthusiasm in the work he had undertaken in the profession to which he belonged. Mr. Woodall was going to make the gas world sit up—anyway, he had made gas-retorts sit up. (Laughter.) What was going to be the end of it all, it was not for him (the Chairman) to say. But he might claim that the Board were going to give their young friends ample opportunities for showing what was in them; and it was for them to show that the Board's confidence had not been misplaced. Having said this, he should like to express his regret that their worthy Secretary (Mr. Cash) was not present; but he would join them later in the day. He was a busy man in the gas industry, and occupied a somewhat unique position in connection with it, as Director, Secretary, and Auditor.

Mr. R. Hesketh Jones proposed "Success to the Southern District Association of Gas Engineers and Managers," for every member of which he wished health, happiness, and prosperity. He remarked that he had the honour six years ago of representing the Company, and inviting the Association to a somewhat similar entertainment to that they were enjoying that day; but the number who honoured them with their presence on that occasion was very small compared with the number that day. However, he thought these excursions were not altogether for holiday purposes, but they had the accompanying object of enabling the members to personally inspect what their *confrères* were doing. They had seen the vertical retorts that day; and they were now going to Poole, to inspect the Company's new works there, with which he thought the members of the Association would be very pleased. It had been a most arduous task on the part of Mr. Woodall to engineer them; and every credit must be given to him, and would be given to him, by the members when they saw the new works. They were most modern works; and he hoped they would be very successful both for the consumers and the shareholders.

Mr. Woodall, on rising to respond as President of the Association, was loudly cheered. He said he had to thank Mr. Hesketh Jones for the very kind words he had used regarding the Association; and Sir George Livesey, the Chairman, and Mr. Jones for the kind words they had uttered in reference to himself. He was sure that every member of the Association did feel the benefit of meeting together, spring, summer, and autumn. While he was sorry his Chairman did not have the opportunity of attending the February meeting of the Association, he would, he (the President) hoped, have the opportunity of attending the autumn meeting, at which Sir George Livesey had promised to read a paper on profit sharing. It must, he (the President) was sure, be pleasing to the members of the Association to find year after year the value that the various Chairmen and Boards of Directors attached to the work of the Association; and he was glad to think that wherever the Association went, they received the same cordial welcome that had been extended to them that day by his honoured Chairman and Board of Directors. It was a source of personal sorrow that his father could not be with them that day; but he was detained in London for reasons over which he had no control. In addition to the welcome received in the various towns they visited, it was also very satisfactory to the members to find the value of the Association recognized as it was by the leaders of the industry. The work of the Association was indeed very valuable, for they had the advantage not only of being able through it to visit works, but through it also of being able to fully discuss with colleagues different problems with which they were from time to time confronted. He cordially thanked Mr. Hesketh Jones for his kind words, and those who had so heartily endorsed them.

THE NEW WORKS AT POOLE.

After the luncheon at the Canford Cliffs Hotel, there was a brief space in which, from the heights, the visitors could enjoy the beautiful view over the sea before starting on the drive to the new Poole gas-works of the Bournemouth Gas and Water Company. *En route* they passed through scenery famous for exquisite beauty. On arrival, the visitors were soon engrossed in the complete new works that Mr. Woodall has put down here, and which has many features indicating the initiative and independence of the Engineer.

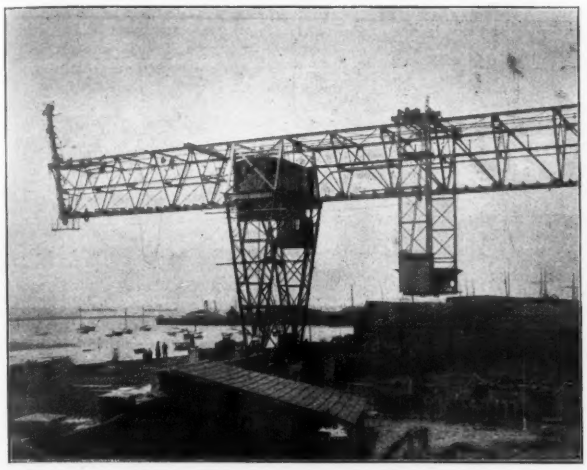


Plan of the New Gas-Works at Poole.

It should be explained that the Company are going to keep the old Bourne Valley works as a gasholder station and manufacturing reserve; the new Poole works, owing to the facility of water carriage, and the modern plant, giving them such economy that the capital outlay that has been involved offers ample compensation. The old Poole works, it may be remembered, came into the hands of the Company by the acquisition of the old Poole Company. But the works in those times stood on a small irregular piece of land, which the coke-hoppers, power-house, and the plant behind them (see plan) now practically cover; and a public road ran right across from the new quay (again see plan) to the old works. The land now used for coal storage was covered with water. To cut a long story short, when the Bournemouth Gas and Water Company wanted to extend, they told the Poole Corporation that they could only enlarge their works if the Corporation would allow them to take in the public road, and straighten the frontage on the quay. There necessarily had to be a great deal of give and take, in which were concerned the Corporation, the Gas Company, the Harbour Board, and, last, the local fishermen, who had established themselves in a small bay formed behind the old quay wall, and to which dock they claimed prescriptive rights. The Harbour Board extended their quay, the Company built a part to meet that of the Harbour Board, the fishermen got a new drying-ground and scaffolding outfit for their nets, crooked ways were made straight, useless ground made useful, and, in fact, a great public improvement was effected through the Company's action. But, of course, it all meant expense; it was a question of expense to obtain convenience and economy. And that is politic procedure. Now on the land there are gas-works the general scheme of which is to take the coal from boats, overhead across the public road, to the coal storage ground, from there through the process of carbonization, and then everything—gas and residuals—has an outlet at the other end of the site. The site favoured the straight-line scheme of working; and now here, excepting the make of the verticals at the Bourne Valley works, the whole of the gas required for the Company's large district is produced. Incidentally it may be mentioned that during the seven years that Mr. Woodall has been Engineer and General Manager to the Company, the consumption of gas has doubled. The annual make is now just over 600 millions—the maximum day's output being a little under 3 millions.

Poole Harbour is not only useful for the incoming coal, but it is so for other supplies and for the despatch of residuals. Underground pipe-lines run to the quay, through which pipes tar can be loaded into barges, and arriving gas-oil for the carburetted water-gas plant can be pumped direct into the works' storage tank.

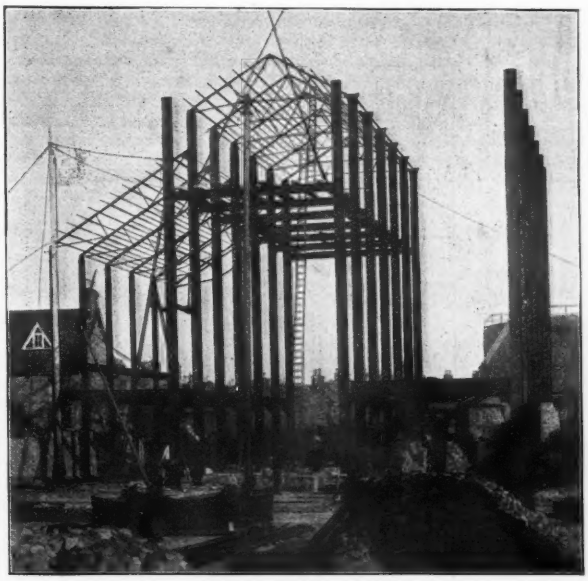
The removal of the coal from the boats is effected by means of a grab transporter; and this has already been described in the "Journal" (*ante*, p. 517). But there are a few points as to the special application of the plant to the purposes of the works which are of interest. The structure, as the illustrations show, is in the form of a bridge, with a clear span of 180 feet between the supporting frames, reaching across the whole coal storage ground lying between the retort-house and the boundary wall of the works on the quay side, and with a cantilever extension of 92 ft. 6 in. passing over the quay and the public road. The portion of the cantilever overhanging the water is made to hinge up, so as not to obstruct the water-way. The transporter can be moved to any part of the storage ground for stacking, or for delivery (wherever the transporter may be) into a gravity bucket conveyor which runs parallel to the rear track of the transporter, and extends the whole length of the coal-store. This conveyor takes a double turn, travelling vertically upwards and along above the overhead hoppers in the retort-house, delivering into them the coal wherever desired. The grab which picks up the coal from the holds of the vessels has a capacity of over a ton. The driver's cabin and the operating machinery for the whole plant are in the front tower of the transporter, and in the other tower is a coal-crusher, hopper, and



The Temperley Coal Transporter Plant.

the gravity-bucket conveyor feeder. A hopper weighing-machine is carried on a frame suspended from the bridge, and arranged to be moved to any position over the stacking-ground, or to a position directly over the coal-crusher hopper. It will therefore be seen that, by this one plant, coal can be mechanically weighed into store, or carried direct into the retort-house, or it can be lifted from store and weighed into the retort-house. The same plant therefore serves a double purpose; so that lifting as it does practically twice the 40,000 tons of coal carbonized per annum, it really deals with 80,000 tons. Mr. Woodall is particularly pleased with this plant. The gravity bucket conveyor was supplied by Messrs. Babcock and Wilcox, Limited. The whole design for the coal plant was got out in the Company's own drawing-office to meet their special requirements; and the Temperley Transporter Company fitted their machinery to those requirements. The Temperley Company, we believe, regard this as the finest transporter they have put up in England. The plant (which is all electrically driven) has been desig ned so that it can deal with the needs of two more retort-houses, when business renders this requisite, and the coal-gas capacity is so raised to 6 or 6½ million cubic feet a day. The restricted character of the land, and the rapid growth of business, in fact has led Mr. Woodall to at once make provision in many parts of the buildings and plant, while erection was proceeding, for the extension of the present output. With the exception of the building for a retort-house (perhaps a house will not be required if the vertical retorts confirm expectations), such plant as would require to be increased could be so extended for the mere cost of the plant and its installation in the places provided. For instance, the power house and the carburetted water-gas plant are all in one block; and the buildings as they stand are sufficient for a 6½ million plant, including the connections and the foundations for exhausters. The Board agreed with their Engineer in taking this broad view as to the future; and all the indications point to the wisdom of their policy.

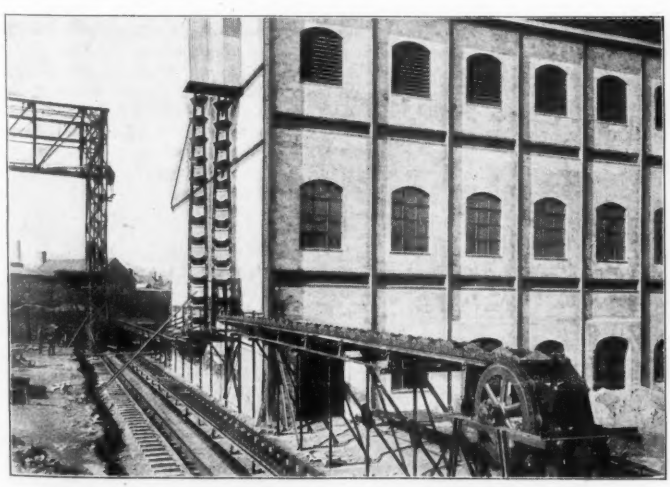
The buildings on these works are among the special features. There is little brickwork about them. The view of the retort-house shows that it is by no means an ordinary building. It is a steel-framed structure, with panels filled in with 9-inch brickwork, cement rendered. In order to cheapen the roof construction, it has been built in two spans and one lean-to section. The first span covers the machine stage, and is a very light roof, carried from the steel joists on the outside, and on the top of the buck-stays on the inside. The second span covers the retort-settings. This section is a very light roof with a louvre in the middle, and is supported off the buckstays direct. The discharging-stage is covered by the lean-to roof supported on the higher side from the buckstays, and at the lower end off the steel framing of the building. The cost of the house was very little; and it would have been less had the foundation been reliable. It is land which not many years ago formed part of Poole Harbour, and consists largely of harbour mud. It is all made-ground; and some of it is 30 feet deep. Naturally one would be anxious about foundations under such circumstances. One of the photographs and a drawing give an idea of the character of the work that was carried out to render the foundation stable. The foot of each buckstay is plated on to horizontal joists which run the whole width of the settings. Beneath these horizontal joists, old railway metals have been laid at right angles, extending the whole length of the foundations of the settings; the joints being properly made with fish-plates, and the intervening space between the rails being filled with concrete. The outside supports of the building were placed on blocks of concrete, so arranged that the superficial load per square foot on the foundations of every part of the building was equal—in fact, there is no uneven load on any part of the structure. As a result, though there has been a small amount of settlement, there is not a crack to be found anywhere in either buildings or settings. It is, to say the least, a highly creditable building.



Building the Steel Structure for the Retort-House.

In the house are ten settings of ten 20 feet through retorts, charged (6½ to 7½ cwt.) by a "D. B." projector carried in a frame running on rails, and discharged by a "De-Brouwer Jenkins" ram. The make of gas is equal to about 8000 to 9000 cubic feet per mouthpiece. The overhead coal-hoppers are continuous, and run the full length of the house; their capacity being equal to twelve hours' supply. Governors have been provided on the top of the beds to regulate the pull; and tar-towers are at the end of the beds to regulate the seal. On the opposite side of the bench, it is found that the coke is discharged into coke-hoppers depending from the stage into the basement, which hoppers, when work is not proceeding, are covered with hinged lids. The hoppers are capacious, so as not to impede the working of the ram. For quenching the coke, the hoppers are fitted with automatic arrangements; but the water pressure available does not allow the quenchers to do their work properly; and additional quenching has to be resorted to. From the hoppers, the coke is delivered into capacious trolley-waggons (hand controlled) in the basement. Messrs. W. J. Jenkins and Co. undertook responsibility for the whole contract; Messrs. Vale and Sons being the sub-contractors, by a special arrangement, for the settings and brickwork.

We have seen the coke removed from the basement to the yard. There the circular coke-waggons are hooked up by a radial transporter (also erected by the Temperley Company), which can be swung in any direction by means of a motor so as to cover the whole of the coke ground, or the coke can be run up into a large overhead hopper, and, by means of a flap inside the hopper, it can be delivered direct on to a Zimmer conveyor-screen, or be put first through a coke-breaker, and then on to the Zimmer conveyor-screen. The coke for the water-gas plant is also provided by this conveyor, and shot into a separate hopper; and it is trucked

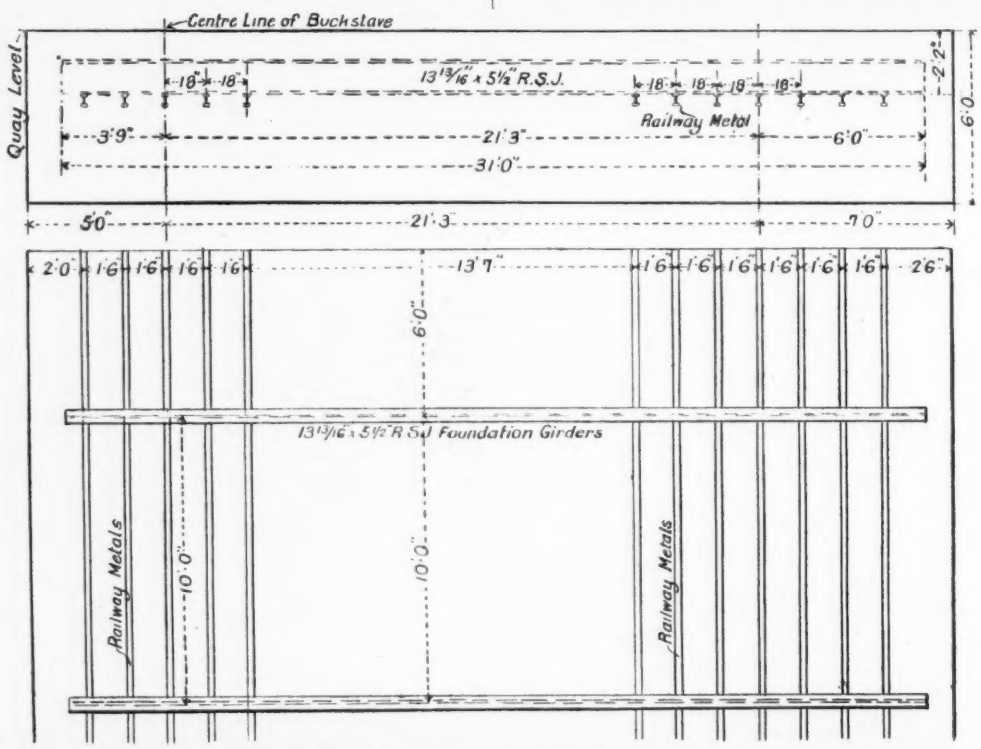


The Gravity-Bucket Conveyor which Receives Coal from the Transporter for Delivery into the Retort-House.

from there by hand direct on to the generating floor of the water-gas plant. But more about this presently. The Zimmer conveyor-screen extends over the whole of the coke-bunkers, and conveys the coke to whichever bunker it belongs, simultaneously screening it—breeze going into the first bunker, the broken coke into the second, and the large into the third.

Now we come to the block of buildings, accommodating the power house, carburetted water-gas plant, the boilers, and the sulphate of ammonia plant. This block is interesting. It is built on the Hennebique reinforced concrete system—even to the roof-supporting beams. One of these concrete beams, with only nine steel rods in it, originally had a clear span of 84 feet, when there was no load on it; but later on, when Mr. Woodall was installing some scrubbing apparatus on top, for safety's sake, he put in some supporting pillars. The roofs of the whole of this block are of reinforced concrete with the exception of the rear of the carburetted water-gas plant house, which for economy's sake was made a lean-to of steel and slate. The price for this building came out slightly lower than it could have been constructed for in the plainest of brickwork; and the buildings were put up in eight months, whereas it would have been practically impossible to have got a brick building of similar extent erected within twelve months in the ordinary manner. The reason for this is that practically the whole of the work can be carried out by unskilled labourers, and a whole army of them can be put on. Where bricklayers have to be employed, the case is notoriously different. The panels of the building are only 6 inches thick; and not the slightest sign of damp or weeping has been detected.

A Railway Metal and Girder Foundation for the Retort-House.



Drawings Illustrating the System adopted for Getting a Stable Foundation for the Retort-House on Made-Ground.

On the Machine Floor of the Retort-House.

In the water-gas part of the building is a Humphreys and Glasgow plant of 1½ millions in all, viz.—two ¾ million sets; and there is space for two more sets. In the power house, we have an interesting collection of machinery. The Temperley Company would obtain the necessary speed of working from their plant using anything else but electricity; and as the De Brouwer retort-house machinery had been selected, it was resolved that nothing better could be done than to drive the main part of the plant on the works by electricity generated by gas-engines. [Mr. Woodall, in passing, mentioned that the Bath Hotel—the largest and most fashionable hotel in Bournemouth—is lighted by electricity generated by gas-engines, and there are several other similar installations in the town.] As a gas engineer, he has not the slightest hostility to electricity for any purpose when generated by engines supplied with gas by his Company; and so far as his own works go, he sees no objection, for convenience, in using "gas-generated power." However, in this fine, light, and spacious house, we find plant the beauty of which is attractive to the engineering eye. There are three three-cylinder Westinghouse gas-engines, of 125-horse power each, direct coupled to 75-kilowatt dynamos. The service is a 230-volt one. There is a watt meter on the large engines, and a continuous diagram watt and volt meter on the main service. There are panels for each main feeder going away from the house. A Campbell gas-engine and

air-compressor are in use for starting the engines. There is also a small motor generator set, for providing the current required for charging the electric accumulators supplying current for ignition purposes; and also two 35 B.H.P. motor-driven fans for the carburetted water-gas plant. The exhausters (supplied by the Bryan Donkin Company), coupled to electric motors, are situated on a raised staging along one side of the house; and the connections below are all accessible. The foundations of the exhausters and the connections are all prepared for extensions.

The boiler-house is situated between the carburetted water-gas house and the sulphate plant house; the situation having been determined by the fact that these are practically the only two places in which steam is required on the works. The two Stirling boilers installed are fitted with underfeed stokers; and the combination is an excellent one. It was at first very doubtful whether the underfeed stokers would be useful for coke breeze; but in the result the efficiency of the combination is found to be everything that could be desired —the ordinary evaporation duty under working conditions being 6½ lbs. of water per pound of breeze, and has averaged over 7 lbs. for a week's working. These boilers are maintained under a constant condition of test, the whole of the fuel being weighed and the water metered. So far as is possible, the whole of the plant on the works is treated in this manner; a daily record of the results being kept and carefully tabulated each week. Passing on to the operating-floor of the water-gas house, another arrangement tending to working economy is observed. We have seen that the coke for the water-gas is wheeled along a short gantry from the coke-hoppers to the water-gas operating-floor. *En route* it is weighed. There is also a doorway from this floor leading over the boilers in the adjoining house; and the same man wheels the coke breeze, weighs it, and delivers it into the hoppers feeding the boilers. There is no question of estimating fuel on these works. Everything is weighed.

In the sulphate-house a Wilton plant, with a centrifugal dryer, has been erected by the Chemical Engineering Company. Here, again, the liquor used is metered and the salt made weighed as delivered into store. The capacity is equal to 2½ tons per twenty-four hours.

Passing out to view other parts of the works, a vacuum plant for pumping all the syphons on the works is pointed out. It is on the system in use at the Tottenham Gas-Works, having been invented by Mr. A. E. Broadberry's assistant, Mr. James Terrace. To Mr. Terrace, Mr. Woodall expressed gratitude for having allowed them to adopt the system at Bournemouth. Another point mentioned as we are walking round was that the works provide their own water supply—the water being pumped from running sand 300 feet below the surface, by a compressed-air plant. Two of the old Poole holders are standing; and these are used for water-gas relief holders. In between them is the water gas separator and a tank with a steam coil through which the exhaust of the pump passes, and which is used for separating the water from the carburetted water gas tar. The last feature is a steel-framed and brick building, with, on the side fronting the works, wooden folding doors from top to bottom. The object of these doors is that they may be unhooked and removed when the plant in the building requires attention, or, when the building requires extension, the doors may be entirely removed in a short space of time, without having any part of the main structure to tear down. In the building, the washer and scrubbing plant is located. There are two Holmes washers, one behind and slightly higher than the other, on the elevated floor; and a Livesey washer is below the second Holmes washer. The weak liquor pump is set to work on the first washer, and the liquor runs by gravity through the whole plant.

One thing we missed on the works, and that was the purifier plant. It was learned that it has found a place behind the town offices and show-rooms; so that the gas really goes through its final purification stage on its journey to the gasholders at Bourne Valley.

From the Left: Sulphate of Ammonia House, Boiler House, Carburetted Water-Gas House, and Power House.

(Range of Buildings on the Hennebique Reinforced Concrete System.)

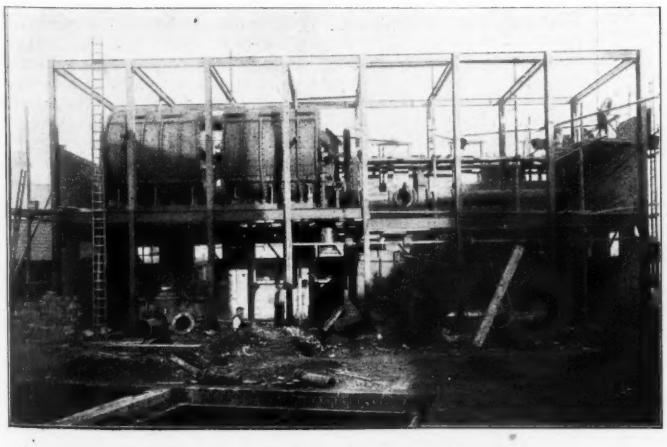
There is one other range of buildings on the works, constituting the offices, store-rooms, men's washing rooms and other necessary accomodation.

It will be seen from this general survey of the new works of the Company that there was a large range of interest to engage the visitors; and it is not too much to say that there was not a single feature of the works over which the members did not linger, and make inquiries of Mr. Woodall, his assistant Mr. Moon, his former assistant Mr. A. M. Duckham, or other members of his staff.

Tea was served in a marquee on the site reserved for future extension of the carbonizing plant. After tea, Mr. J. W. Helps, in an interesting little speech, expressed the great appreciation of the members to the President for inviting them to his new works and for allowing them to inspect the latest that had been done, and to hear the last word so far, in regard to vertical retorts. They expected a great deal from Mr. Woodall, and they had not been disappointed. His talents comprised mechanical and electrical engineering; and, with a combination of this kind, they expected rather more than in the case of the man who had not had the same opportunities. With regard to the vertical retorts, he (Mr. Helps) had seen them in difficulties and in success; and that day he had witnessed them working as he had never seen them work before. If Mr. Woodall could continue in the same direction, then these retorts marked an epoch in the history of gas-making. At the new Poole works, they saw a large producing plant on a small space; and there was here exemplification of generous application and earnestness. The members much appreciated Mr. Woodall's kindness, and that of his Directors. There was not an engineer present who did not heartily appreciate the kindly words the Chairman (Mr. G. Crispe Whiteley) had spoken as to the attitude that Directors should bear towards their engineers. When Directors in the first place got good men, then they should trust them.

Three cheers were lustily given for Mr. Woodall, who, in his acknowledgment, asked the members to believe him that they were indebted that day more to his Chairman and Directors than to himself. He was indebted to the Directors for the kindness they had always shown him, and for the line of policy they had always adopted.

After witnessing the six o'clock discharging and charging of some of the retorts by the De Brouwer machinery, the visitors made their way to the Poole Station, homeward bound—all, we are sure feeling, that the day was one which would ever stay in memory, and cogitating over the demonstration they had seen of continuous carbonization. Is it the beginning of a new order of things in gas production?



Conserving Space by Elevating the Washer-Scrubbers

The town of Bridgwater has lost a highly respected burgess, and the Gas Company a valued member of the directorate, by the recent death, in his 76th year, of Alderman G. Bryant Sully, J.P. Deceased left England in April, apparently in the best of health, for his annual trip to the Italian lakes. On his way home, however, he took cold; but he succeeded in reaching Brussels, where pneumonia set in, to which he succumbed. He had been connected with the Company as a Director for 48 years, and for about 15 years filled the position of Chairman. He was also, for the long period of 32 years, Auditor, until the reconstruction of the Company and the passing of their new Act in 1903. He was an excellent man of business, well informed, of sound judgment, exceptional ability, and great integrity; and he will be very much missed, not only by his colleagues in the Company, but by the whole body of his fellow-townsmen. The funeral took place on the 25th ult.; and its representative character testified to the high esteem in which the deceased gentleman was held.

EARLY WORKS ON GAS LIGHTING.

Since the publication of the list of early works on gas lighting compiled by Mr. F. S. Cripps (*ante*, p. 513), the Librarian of the Patent Office has sent him notes on two other important publications, as follows:—

1823. HOME OFFICE. P.O.

Gaslight Establishments. Report of the Royal Society . . . on the subject of Gaslight [1814]; and Reports of the Person appointed to Inspect the Gaslight Establishments existing in the Metropolis (*i.e.*, Sir William Congreve) [1822].

London: Folio, 41 pp.

1823. PARLIAMENT. P.O.

Report from the Select Committee on Gaslight Establishments.

London: Folio, 89 pp.

In our "Correspondence" columns will be found a letter from Mr. Cripps, in the course of which he suggests that the titles of, and any information concerning, books, pamphlets, &c., not included in his list (which, it will be noted, covers a period up to 1840), should be printed in the "Journal," under the heading of "Early Works on Gas and Gas Lighting." We gladly adopt the suggestion, and shall welcome any information of the kind from our readers. As mentioned elsewhere, Mr. Cripps's list is being printed in pamphlet form with wide margins and blank leaves for notes and additions, and copies will be ready shortly.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Programme and Papers for the Annual Meeting.

In the "Journal" for the 30th of April (p. 292) we gave the provisional programme of this year's gathering at Nancy of French gas engineers. We have just received the final and full programme of the proceedings, and list of papers to be read. The order of business and the excursions to various works and places remain more or less as already stated. Apparently the nocturnal visit, at half-past ten, to the Nancy Gas-Works is dropped, the hour being altered to five o'clock.

A new subject has been added to those to be discussed at the special "Séance de Discussions," which, as will be remembered, is a fresh feature in this year's Congress. The subject is the standardizing of screw-threads of gas fittings and apparatus, which the Committee thought it well to add, in view of the solution of the question that was proposed at the Paris Congress in 1902; and, further, in view of what was done by the International Committee on Photometry at Zurich in 1903. As this International Committee is shortly to meet again, and as the representatives of the various countries ought then to put forward some definite proposals, the Société Technique rightly think that a previous discussion of the subject among its members should be useful.

The list of papers to be read this year is shorter than usual; there being seventeen papers contributed by fourteen authors. M. Sar has three against his name—one dealing with the filling of tar or liquor tank-waggons, and their emptying by means of compressed air; another refers to methods to be adopted for increasing the sales of coke; and the third proposes regulations as to vibrations caused by tramways. M. Chapat again refers to a School of Gas and a Dictionary for the Gas Industry. "Mechanical Conveying in Gas-Works" is M. Lacaze's subject; and M. Cabrier is also again to describe a charging-machine. Meters of one form or another are in the hands of M. Chamon and M. Parsy; while M. Heeley has a paper on an automatic governor. M. Casaubon has made investigations on the part played by diffusion in flames. The Féry calorimeter is to be described by M. Henri Foiret; and M. Verdier has a note on a new pyrometer which gives direct readings. M. Dorigny describes an inverted burner; and M. Roche has a paper on suction producers, in which he examines some advantages and disadvantages of chemical purifiers for poor gas. A paper on methane by M. Chervet, and one dealing with the utilization of coke dust by M. Marcou, complete the list.

Another important and new business item to be considered at the opening general meeting is a proposal to institute a reserve and benefit fund for gas engineers and managers. A report by the Committee, dealing with this matter, will be read.

M. Coze, this year's President, in his circular-letter, calls attention to the fact that the programme of the meetings at Nancy is a very full one, extending practically from Tuesday morning, the 11th inst., to the following Saturday night. It is most important, he says, that the times given in the programme for the various items should be scrupulously adhered to, if the work is to be got through. We hope that next week's gathering of our French friends and colleagues will be fraught with every success.

The gross value of the estate of the late Mr. J. S. Keep, the Chairman of the Horseley Company, Limited, is £69,377, with net personalty amounting to £68,735.

PURIFICATION AND TAR FOG.

[Two Papers read before the Manchester District Institution of Gas Engineers.]

(1.)
PURIFICATION.

By G. H. Niven, of Cleckheaton.

When we use the word purification as applied to coal gas, I take it that we do not refer alone to that part of the process which operates in the oxide of iron or dry lime purifiers, but to that larger process which begins to operate in the retort-house; for I think we shall all be agreed on this point—that purification begins as soon as distillation ceases. The amount of purification required depends very largely on the temperatures under which distillation takes place, as it has been proved that the sulphur compounds vary with the temperature. According to Mr. Lewis T. Wright, the relation between temperature and sulphur compounds is as follows:—

Yield of Gas per Ton of Coal.	Sulphur per 100 Cubic Feet.
6,873 cubic feet	13·9 grains
8,370 ,, ,,	19·1 ,,
9,431 ,, ,,	26·7 ,,
10,772 ,, ,,	36·9 ,,
11,620 ,, ,,	44·1 ,,

This is after the sulphuretted hydrogen had been removed.

The crude gas as it passes up the ascension pipes to the hydraulic main contains as impurities tarry bodies (impure hydrocarbons), carbonic acid, sulphuretted hydrogen, ammonia, cyanogen compounds, and sulphur compounds other than sulphuretted hydrogen. According to Professor Wanklyn, gas as it leaves the retorts is accompanied by rather less than one-third of its weight of tar, by nearly half its weight of watery vapour, by about $\frac{1}{50}$th of its weight of ammonia, by a little more than $\frac{1}{20}$th of its weight of carbonic acid, by from $\frac{1}{50}$th to $\frac{1}{20}$th of its weight of sulphuretted hydrogen, and by from $\frac{1}{300}$ to $\frac{1}{600}$ of its weight of sulphur in the condition of sulphuret of carbon, &c. In the process of purification, all these impurities have to be dealt with in such a manner as to bring them to a minimum quantity, if not to altogether eliminate them.

Before we begin to discuss the methods of purification by which these impurities are removed from the gas, it will perhaps be advisable to give the reason for their removal. We will take first carbonic acid. This gas is both colourless and odourless; it will neither burn nor support combustion, and is slightly acid in taste and reaction. Carbonic acid is chiefly objectionable owing to its exercising a lowering of the illuminating power of coal gas. Sulphuretted hydrogen is also a colourless gas having a sweet taste, and an odour of rotten eggs. When it is present in large quantities it is very poisonous, and, like carbonic acid, is freely soluble in water. It has a feeble acid action; but, unlike carbonic acid, it burns in air or oxygen, producing sulphurous acid or sulphur, according to the quantity of air. Besides being a decidedly poisonous gas, it tarnishes bright metal work. Ammonia is also a colourless gas; but of a very pungent odour. It has a very strong alkaline reaction, and, like carbonic acid and sulphuretted hydrogen, is extremely soluble in water. Carbon disulphide is also colourless; but it is a liquid, extremely volatile and of most disagreeable odour, and is only very slightly soluble in water. Of the cyanides, I think I need not trouble to speak, as they play no very important part.

Having briefly described the impurities to be dealt with, I will now address myself to the processes of purification through which the crude gas has to pass. There is no doubt but that condensation is the first process in purification. The gas as it enters the hydraulic main is at a temperature of (say) 140° to 180° Fahr., and contains all the impurities referred to; but on entering the hydraulic, the temperature of the gas begins to lower. With this decrease of temperature, the heavier portions of the tar are deposited in the main, and the law of synthesis begins to operate, and new combinations are born, which have to be dealt with at a later part of the process.

Leaving the hydraulic, the gas passes on into the foul main. This can scarcely be called an apparatus—having no working parts. Yet to my mind it plays a most important part in the economy of purification, as it is in this main that, to a large extent, the naphthalene troubles are determined and controlled—the length, position, and temperature of which are the determining factors. It is here that the first real separation of the gas and liquids takes place; and the manner of, and time for, such separation has for a long while been a bone of contention among gas engineers. Some engineers go in for separation as soon as possible after leaving the hydraulic; while others allow the tar, liquor, and the gas to flow together until they are separated by the condensers. Personally, I certainly favour this idea, my reasons for which I will proceed to give.

When tar is deposited in the hydraulic main, it gives off quite a quantity of naphtha vapour. Such naphtha vapour has the power of arresting naphthalene in its formation and depositing its constituents in the tar; and I hold that the longer these naphtha vapours are kept free, the less fear we have of naphthalene troubles. Besides which, I find that in my own works I benefit in candle power by employing this process. My foul main is of mild steel, 15 inches in diameter, and is fixed at a distance of 5 feet from the front of the retort-bench. It travels the whole length of the

bench, and is laid with a slight fall towards the hydraulic main; so that the tar may leave slowly, and may the while have the benefit of the radiated heat from the bench and the retort-house wall. By this means the gas is very slowly cooled before either the tar or the ammoniacal liquor is separated from it. The tar, owing to its density, retains its heat longer than the gas, and by this means no deleterious effect can take place.

We now come to the condensers. These are of varying form, according to the ideas of the constructing engineer. But though this may be so, they are all employed for the same purpose—viz., cooling the gas and separating therefrom all suspended matter. As to the amount of condensing power required, much depends on the condition and temperature of the gas when it enters the condensers. Many forms of condensers are employed; but I think those found in modern works are of the annular type, and are, to my mind, the best, as the damper arrangement at the bottom of the tubes enables the temperatures to be very easily controlled. Gas enters the condensers at varying temperatures—in fact, I do not know of any royal law as to inlet temperature, provided the apparatus is large enough to enable one to bring about not only a more or less large reduction in temperature, but also a thorough deposition of those vesicles formed of hydrocarbons and water and other vapours which are at this point still in suspension in the gas.

Now, I would like to impress upon you the importance of ridding the gas of these vesicles, which float, so to speak, like so many minute bladders in its volume, because their presence not only robs the scrubber liquor of its power to absorb the ammonia, but they are also a source of trouble at a later period—viz., in the oxide of iron purifiers. This is especially the case where the atmospheric oxygen process is not employed, as on their arrival in the purifiers they are broken up by contact with the particles of oxide. These particles are covered with a kind of film, which robs the oxide of part of its absorbtive power over the sulphuretted hydrogen. Where the atmospheric oxygen process is in vogue, this is in some measure obviated, as, owing to the slight elevation of temperature brought about by the oxidation of the metal, this film is again vaporized and sent forward, sometimes causing some trouble in the mains and services by the formation and deposition of naphthalene.

It is obvious, then, that we require some means of extracting these little vesicles from the gas before its entry into the scrubbers; and we find this in the tar extractor, a new kind of which has been recently patented by one of our own members, and which I hear is giving every satisfaction. Having had one fixed at my own works, I can bear the same testimony as to its worth. The simplicity of its construction is not by any means the least of its recommendations. The gas is made to pass through a series of wire discs of varying mesh, on the faces of which a light volume of exhaust steam is caused to play; while the size of the discs can be altered to suit the varying flows by means of a waterline valve arrangement. The exhaust steam heats up the tar in the gas, and enables it to remove the maximum amount of naphthalene; and as the tar in this case acts as the carrier for the naphthalene, by the removal of the tar, we are at once rid of a large amount which goes to make up the sum of our naphthalene troubles.

We now come to another part of the system of purification—viz., scrubbing and washing. This is, in its turn, as important as any other section of the system, as a great deal of its success depends upon the successful handling of the gas up to this point. The duties of the scrubber and the scrubber-washer are really of a threefold nature, as during the process of washing the ammonia, the sulphuretted hydrogen, and the carbonic acid have all to be dealt with. Gas after condensation, but before washing (from common coal), may be said to have, on the average, the following composition:—

Hydrogen from	42	to 53	per cent. by volume.	
Methane ,, ...	32	,, 39	,,	,,
Carbon monoxide. . . .	3	,, 9	,,	,,
Gaseous hydrocarbons . .	2·5	,, 4·5	,,	,,
Light condensable vapours.	0·5	,, 1·2	,,	,,
Carbon dioxide	1·1	,, 1·8	,,	,,
Nitrogen	1·0	,, 5·0	,,	,,
Hydrogen sulphate . . .	1·0	,, 2·0	,,	,,
Ammonia	0·5	,, 0·95	,,	,,
Cyanogen	0·05	,, 0·12	,,	,,
Carbon disulphide . . .	0·020	,, 0·035	,,	,,

Gas also contains very small amounts of sulphur compounds, not enumerated. It is also at this point still more or less saturated with aqueous vapour; and in this condition it enters the scrubbers. The primary object of the scrubbers is to remove as much as possible of the ammonia from the gas; and as water is said to be capable of taking up 700 volumes of ammonia gas, one would conclude that the more water used in the scrubbing process the purer would the gas be. So it would, so far as the picking up of the free ammonia was concerned; but as water has the power to dissolve small quantities of the illuminating hydrocarbons, the gas would suffer in illuminating efficiency by its excessive use.

This suggests that the rule-of-thumb which is in vogue at some works is not the law calculated to serve the best interest of the concern. It also suggests that there are certain relationships between the gas to be purified and the materials or forces employed to purify it. Now let us see if we thoroughly understand this statement. Let us first of all consider what is meant by the removal of ammonia. If the crude gas be scrubbed with a continuous supply of clean water, as the scrubbing proceeds the ammonia will be gradually removed until its action on the litmus or turmeric paper is entirely lost; nay, more, if the process be still continued a slight acid reaction will take place, due to the carbonic acid and hydrosulphuric acid in the gas. This phenomenon is thus explained. The acid gases (carbonic acid *plus* sulphuretted hydrogen) mask the alkaline reactions of free ammonia in the gas, when such gas contains not more than about 1½ grains of free ammonia in 100 cubic feet of coal gas.

Another phenomenon often presents itself in the course of purification, which proves that vapour tensions play an important part in the chemistry of it. It is frequently found, on testing gas at the outlet of the washer, that there is no reaction shown on the test paper; but on the gas being tested at the outlet of the first purifier, the presence of ammonia is shown in a more or less marked degree. This reaction is brought about by an elevation of the temperature of the gas which is passing through the purifier, such elevation being caused by some chemical change within the purifier, or by the increase in the temperature of the atmosphere without, causing thereby a movement in the vapour tension of the ammonia contained in some other form than that termed free, proving that the carbonic acid and the sulphuretted hydrogen are no longer present in the purifier to mask the alkaline reaction of the ammonia. The duty of the scrubbers then is that the work in them should be done by as small a quantity of water as is consistent with the removal of the ammonia.

We will now turn our attention to the washer. This apparatus has, to my mind, a decided advantage as a purifier over the ordinary tower scrubber, in as much as it is divided into compartments, which are made to contain liquor of varying strengths. Gas after it has passed through the scrubbers should be free from all tarry matter. It is then in a condition to enter on its last stage of liquid purification—viz., the washer. This apparatus, as already mentioned, is divided into compartments fitted with suitable overflows. It is fed with clean water from its outlet end, and the brushes, or baskets of wooden balls, as they rotate on the shaft, dip into the water contained in the compartments, and offer thereby a continuity of wetted surfaces to the incoming gas. Each compartment then will contain a different strength of liquor; and each in its turn will be called upon to perform its task in the economy of purification. The strongest liquor will be, or ought to be, at the inlet end of the apparatus, and where the liquor overflows are fixed. The reason of this is obvious, as alkalies neutralize acids, forming salts.

It would appear then that the more ammonia contained in the liquor in the (say) first and second chambers of the apparatus, counting from the inlet end, would make the purification of the incoming gases more effective and complete; and so far as the carbonic acid and the sulphuretted hydrogen are concerned, it would undoubtedly be so. But, as I have before stated, the behaviour of ammoniacal gas is most erratic and deceptive, the reason of which is not far to seek. The ammonia taken up by the liquor enters into combination with the carbonic acid and the hydro-sulphuric acid in varying proportions. Gas liquor contains both sulphides and carbonates; but they are not very stable compounds, and are easily broken up into their component parts by the slightest change in temperature and pressure, and the ammonia thus freed will be evolved from the liquor. So it appears to me that, after all, a slight excess of water is necessary to meet those changes in the developments of ammoniacal gas. In my own works, I use from 10 to 12 gallons of water per ton of coal.

On leaving the washer, the gas will contain, on the average, from 500 to 800 grains of sulphuretted hydrogen and from 700 to 1000 grains of carbonic acid per 100 cubic feet, and some 30 or 40 grains of sulphur compounds. These impurities have to be removed or minimized in the oxide of iron or dry lime purifiers. In the removal of these impurities by the dry process, gas engineers have varying ideas. For instance, some believe in removing the carbonic acid as soon as the gas has left the washer by passing it through the lime purifier; while others make a point of removing the hydrosulphuric acid first, by passing the gas through the oxide purifier. For myself, I could never see any chance or reason to attempt successfully to draw any hard-and-fast line. So long as the means employed brings about the state of purity required by the Gas-Works Clauses Acts, I do not think we need trouble as to which impurity is removed the first.

In oxide purification, much of its success depends on the choice and preparation of the material. Given that the material is all that can be desired, much depends upon its condition in respect to moisture when it is placed in the box. I am speaking now, of course, of the amount of water added to the material after revivification. Some engineers have an idea that the more water it will carry after revivification the better. But this is not the case, as I have found by experiment that an excess of water only tends to fill up the minute cells in the oxide, and so prevents the gas from being able to get at its every part. I have found in practice that just the amount of water which will give to the particles an adhesiveness so that they will not percolate through the grates is all that is required. The chief business of the oxide is to take up the hydrosulphuric acid. This it readily does; and it does more. Under certain conditions, it also takes up carbon disulphide in small quantities. This, of course, is after the oxide has been several times revivified, and the sulphur is in a finely divided state.

Before leaving the oxide purifier, I would like to say that not a small part of the success of purification depends on the pressure which the oxide itself exerts. I have often found that where oxide has been put in in a deep layer and very wet, it has offered

such a resistance to the gas that it has not been able to permeate the bulk, but has found or made short-circuits for itself; and when the material has been taken out it has been found to be in a kind of half-spent condition. This state of things is also brought about by the careless way the water is added to the oxide in its preparation for the box after revivification. In the preparation of the material great care should be exercised in the application of water, as it will be found that any of the material which has been made excessively wet will lay very close, and thereby offer greater resistance to the gas. The moisture will also, as before stated, fill up the pores in the material, and so rob it of its effectiveness as an absorbent of the hydrosulphuric acid. The same may be said of the preparation of lime, so far as the resistance is concerned by the application of moisture.

Now, just a line as to the *modus operandi*. Of course, I offer these remarks for what they are worth, and am not suggesting that the system in vogue on my works is by any means the best. Each engineer has his own ideas as to what is best to meet the requirements of his own particular works, and can, no doubt, give palpable reasons why he operates after his fashion. On my works, after the gas has left the scrubber-washer I pass it through three boxes of oxide of iron—each box varying in the amount of sulphur contained in the oxide. The reason for my employing oxide of different degrees of sulphur is that, as before stated, oxide of iron will, under certain conditions, absorb small amounts of carbon disulphide.

After the gas has passed the third oxide purifier, it then enters the first lime purifier. This is charged in the following order: The two bottom grids are loaded with lime from the store, about 4 inches thick; the third grid is loaded with lime which has been sulphided in a previous operation; and the top grid is again loaded with lime from the store. The second lime purifier is charged—the two bottom tiers with lime from the store; the third tier with lime previously sulphided; and the top tier with a 6-inch layer of oxide of iron.

In conclusion, let me say that I have not attempted to go into the higher technics of this important question, feeling assured that there are connected with our Institution more able exponents of the varying problems that arise in connection with the chemistry of gas purification than I myself am. But if I have been able to put before you anything which will bring about a healthy discussion, I shall try to persuade myself that my labour has not been in vain.

(2.)

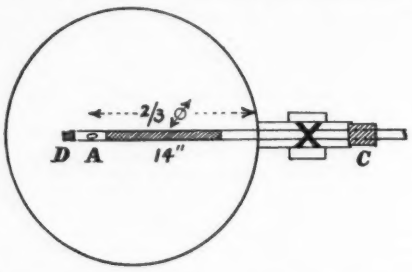
ESTIMATION OF TAR FOG AND ITS SEPARATION FROM GASES.

By R. H. Clayton, B.Sc., and F. W. Skirrow, Ph.D.

The question of the separation of tar fog is one which is at present engaging the attention of the gas industry, as is seen by the various patents which have recently been taken out; and as we have lately done some work on the question, we have ventured to think that our results would not be without interest to members of the Institution.

Our attention was first drawn to the subject by the presence of varying quantities of tar in spent oxide. A large number of samples from various gas-works were examined; and it was found that the percentage of tar in oxide which had been used for coal-gas purification varied from 0·8 to 13 per cent. on the sulphur as estimated by the bisulphide test, and on oxides obtained from water-gas plants the percentage of tar rose to as much as 50 per cent. on the carbon bisulphide extract. In water gas, it is an acknowledged fact that the oils passing forward rapidly clog up the purifying oxide, and necessitate either its being thrown away or sold at a fraction of the value which should be obtained for it. It is in some cases worked up in the coal-gas purifiers; but tests which we have made show that the tar already present is in no wise taken up by the coal gas, but remains as a dead-load on the purifying material. While this is a determining factor in the case of water-gas purification—in fact, it very often compels the use of lime, and this in a very inefficient manner—the same effect must take place, but in a less degree, in the ordinary coal-gas purification.

These general considerations led us to undertake the estimation of the actual amounts of tar fog in the gas passing forward through the various parts of the plant before the purifiers. A series of preliminary experiments were carried out in order to obtain a satisfactory method of estimation. The general principle of the method adopted was to filter off a measured volume of gas through a suitable filter, and then to estimate the tar oils retained in the filtering medium. After obtaining very inconstant results in our first estimations, we found that the error arose through the neglect of the following conditions: (*a*) The sample tube with the filtering medium is best placed inside the main, so that the tar fog separated is kept at the same temperature as the gas. (*b*) The sample must be drawn from the point of average velocity, which is one-third of the diameter from the side of the main. (*c*) The inlet to the tube should, if possible, face the current of gas. (*d*) The velocity of the gas through the inlet orifice of the tube must be greater than the velocity of the gas in the main. It is best to arrange for it to be from one-and-a-half times to twice the velocity of the gas in the main. Our experiments showed that, when these conditions were maintained, entirely consistent results were obtained. These observations are wholly in harmony with those of the late Dr. Hurter, who worked out the necessary conditions for the estimation of suspended particles in moving gases. In a recent paper by Professor White and J. M. Barnes, before the Michigan Gas Association ["Journal of Gas Lighting," Vol. XCVI., pp. 181, 244, 324], much valuable time was wasted and results lost owing to the samples not being taken under these conditions. In their case, the gas was sampled from the edge of the main; while the speed of the gas through the orifice was not taken into consideration.



The following is the detailed method of estimation of the tar fog in the gas. The main is tapped and a 1-inch pipe with a 1½-inch tap screwed in. This must be 1½ inches to allow the glass filtering tube to be put through into the main. The glass filtering gauge tube, ¾-inch outside diameter, is put through a rubber stopper C, and the length so arranged that the hole A is two-thirds (exactly) across the main. This is the point of mean velocity of the gas in the main. The filtering tube is closed at the end by a cork D, and the hole A is placed so as to face the current in the main, except in cases where the current is upward and the tar is so excessive that loss by drainage might be feared—say, before the Pelouze and Audouin extractor. The diameter of the hole in A should be about ¼ inch. The current of gas should be taken through the tube at such a speed that the velocity of the gas through A is greater than (say, twice as great as) the velocity of the gas in the main. The gas passes through 12 inches of very lightly packed cotton wool, which has previously been extracted with carbon bisulphide, care being taken that all the tube containing the cotton wool is in the main, and therefore at the same temperature as the gas. This prevents condensation. Generally, 20 or 30 cubic feet of the gas are taken. After the sample has been taken, the tube is removed and any naphthalene which has condensed in the cooler and exterior part of the tube is carefully separated and removed, the cotton wool is pushed out into a soxhlet, and extracted with carbon bisulphide. After extraction, the bisulphide is evaporated off on the water bath, which is finally brought to 100° C. The flask is then quickly cooled, and a current of air passed through for half-a-minute. The cool flask is then weighed. Estimations on these lines were carried out at various works where we had the privilege of working; and the results are tabulated below.

Works "A."—Tests at the Outlet from the Kirkham Washer to the Purifiers.

Table I.—*Nov. 1 to 5, 1906.*

No.	Temperature of Gas.	Grammes of Tar per 100 Cubic Feet.*
1 . . .	66·5° Fahr.	1·55
2 . . .	66·5° ,,	1·58
3 . . .	66·5° ,,	1·28
4 . . .	65·0° ,,	1·35

* All figures in this paper refer to tar soluble in carbon bisulphide; no account being taken of free carbon, which would make the results come out from 10-20 per cent. higher.

At this works a Kirkham washer and a Clapham washer were being worked in parallel. In Table II. are given the results of simultaneous determinations of the tar fog at the inlet to the washers and at the outlet from the Kirkham washer and at the outlet from the Clapham washer.

Table II.—*Dec. 14 to 19, 1906.*

No.	Point Tested.	Temperature.	Grammes of Tar per 100 Cubic Feet.
1 . .	Inlet, Washers.	66·5° Fahr.	1·51
	Outlet, Clapham.	60·5° ,,	1 21
	Outlet, Kirkham.	61·5° ,,	1·15
2 . .	Inlet, Washers.	69·5° ,,	1·51
	Outlet, Clapham.	61·5° ,,	1·34
	Outlet, Kirkham.	63·5° ,,	1·20
3 . .	Inlet, Washers.	74·0° ,,	1·54
	Outlet, Clapham.	70·5° ,,	1·44
	Outlet, Kirkham.	70·5° ,,	1·60
4 . .	Inlet, Washers.	73·5° ,,	1·44
	Outlet, Clapham.	70·0° ,,	1·20
	Outlet, Kirkham.	70·5° ,,	1·35

We then turned our attention to the Livesey washers, and to the determination of their efficiency as tar-extractors. Simultaneous tests were made of the amount of tar in the gas at the

inlet and the outlet of the washer. The results obtained are given in Table III.:—

TABLE III.—*Dec.* 19, 1906.

No.	—	Temperature.	Grammes of Tar per 100 Cubic Feet.	Purification, Per Cent.
1 . .	Inlet.	75° Fahr.	11·26	..
	Outlet.	74° ,,	1·54	86·3
2 . .	Inlet.	73° ,,	10·92	..
	Outlet.	73° ,,	1·44	86·8
		Feb. 10, 1907.		
3 . .	Inlet.	..	10·50	..
	Outlet.	..	1·39	86·8

Tests were also carried out on the efficiency of the Livesey washers at another gas-works, where the following results were obtained.

TABLE IV.—*Works "B," Jan.* 11 *to* 14, 1907.

No.	—	Temperature.	Grammes of Tar per 100 Cubic Feet.	Purification, Per Cent.
1 . .	Inlet.	86·5° Fahr.	3·71	..
	Outlet.	..	0·44	88·1
2 . .	Inlet.	84·5° ,,	3·58	..
	Outlet.	..	0·54	84·9
3 . .	Inlet.	84·2° ,,	4·05	..
	Outlet.	..	0·52	87·2

From these results we see that the Livesey washer is not a very perfect form of tar-extractor; and although at Works "B" the amount of tar left in the gas at the outlet from the Livesey washer is considerably smaller than is the case at Works "A," yet we see that the percentage efficiency is practically the same in both cases.

The elimination of the tar by a Livesey washer being unsatisfactory, and the fact that oxide so often contains tarry matter being undoubtedly due to this cause, we determined to examine the efficiency of other tar-extractors. On looking round, we found that the two principles most adopted were the impact method and the centrifugal method; and we decided to test the efficiency of these two types. The first type examined was the one in most common use—viz., the Pelouze and Audouin tar-extractor; and the efficiency of this machine was studied under various conditions. Simultaneous tests were made at the inlet and outlet of the machine, the temperature and differential pressure being noted. This tar-extractor was one fitted with six plates—*i.e.*, the gas was subjected to three impacts during its passage through the machine. The size of the holes was $\frac{3}{64}$ inch, and the distance between the perforated plate and the slotted impact plate was $\frac{1}{16}$ inch. The capacity of the machine was 3 million cubic feet per 24 hours. The tests were carried out as described previously; and the following results were obtained:—

TABLE V.—*Nov.* 14 *to Dec.* 17, 1906.

Differential Pressure.	Temperature (Inlet).	Tar (Inlet) 100 Cubic Feet.	Tar (Outlet) 100 Cubic Feet.	Purification, Per Cent.
3·12 inches	73·3° Fahr.	16·86 gr.	0·267 gr.	98·4
3·12 ,,	74·4° ,,	16·38 ,,	0·258 ,,	98·4
3·00 ,,	74·0° ,,	15·15 ,,	0·302 ,,	98·0
3·12 ,,	80°–88° ,,	12·14 ,,	0·242 ,,	98·0
3·16 ,,	72·5° ,,	10·71 ,,	0·258 ,,	97·6

Tests were also made at the inlet to the purifiers after the gas had passed through the cyanide, ammonia, and naphthalene washers, and the amount of tar found was as follows:—

TABLE VI.

No.	Temperature.	Grammes of Tar per 100 Cubic Feet.
1 . . .	60·6° Fahr.	0·162
2 . . .	59·2° ,,	0·149

The above results show that the tar can practically be completely eliminated by the proper use of a Pelouze and Audouin tar-extractor.

From inquiries which we have made, we have found that Pelouze and Audouin tar-extractors are often worked at considerably lower differential pressures than the above; and we determined to try the effect of different differential pressures, with the following results:—

TABLE VII.

Differential Pressure.	Temperature (Inlet).	Tar (Inlet) 100 Cubic Feet.	Tar (Outlet) 100 Cubic Feet.	Purification, Per Cent.
4·75 inches	72·5° Fahr.	11·33 gr.	0·126 gr.	98·9
4·62 ,,	62·0° ,,	15·21 ,,	0·133 ,,	99·1
4·50 ,,	65·0° ,,	15·54 ,,	0·156 ,,	99·0
4·75 ,,	81·0° ,,	11·72 ,,	0·185 ,,	98·4
4·81 ,,	83·8° ,,	12·89 ,,	0·155 ,,	98·8
2·00 ,,	71·2° ,,	15 00 ,,	0·421 ,,	97·2
2·00 ,,	71·7° ,,	15·56 ,,	0·420 ,,	97·3
1·50 ,,	69·0° ,,	10·98 ,,	4·890 ,,	55·4
1 50 ,,	68·0° ,,	11·05 ,,	3·410 ,,	69·2

We see from the preceding tables that the efficiency of the machine falls off regularly from 4·7 inches down to 2 inches. Closely below this pressure the machine ceases to work efficiently, and half the tar passes forward. From Pole's formula for the velocity of gases through pipes—

$$Q = 1{\cdot}350\, d^2 \sqrt{\frac{h \times d}{s \times l}}$$

where Q = cubic feet of gas per hour
h = pressure in inches of water

we see that the volume of gas passed through a given number of holes is proportional to the square root of the pressure difference; and we can readily see that it the differential pressure be reduced to $1\frac{1}{2}$ inches, the number of holes which would be necessary in order to pass the whole of the gas would be very much greater than at the higher pressures. As a matter of fact, an apparatus designed to deal with 3 million cubic feet at $3\frac{1}{4}$ inches differential pressure would only pass 2 million cubic feet at $1\frac{1}{2}$ inches. Consequently, at $1\frac{1}{2}$ inches the apparatus would have to be half as large again in order to deal with 3 million cubic feet per day. As a consequence, at the lower differential pressure the cage would be raised so far out of the tar-seal that the bulk of the gas would be bubbling under the cage. In order to prove this point, a test was made in a portion of the gas only, so that the capacity of the cage would be great enough for all the flow to be through the perforations. In order to do this, the cage was set for 3-inch differential pressure; and the apparatus was then so far bye-passed that the differential pressure fell to $1\frac{1}{2}$ inches. The results are given in Table VIII.

TABLE VIII.

Differential Pressure.	Temperature (Inlet).	Tar (Inlet) 100 Cubic Feet.	Tar (Outlet) 100 Cubic Feet.
1·31 inches	67·0° Fahr.	24·86 gr.	0·834 gr.
1·56 ,,	66·5° ,,	23·24 ,,	0·513 ,,

These results were obtained under somewhat abnormal conditions, due to the partial bye-passing of the gas; and this would probably explain the somewhat larger amount of tar at the inlet. We see, however, from the curve that the amount of tar left in the gas now corresponds to what we should expect from the results obtained at the other pressures. These results show definitely that for the best working the differential pressure must be between 3 and 4 inches. But if this be impossible, the installation must be much larger to deal with the same volume of gas, in which case, however, the efficiency would not be so great.

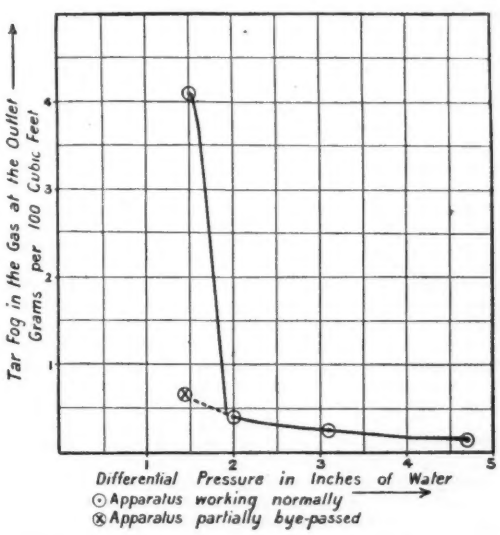
The following table contains the average of the results given in the Tables V. to VIII.:—

TABLE IX.

Differential Pressure.	Tar (Inlet) 100 Cubic Feet.	Tar (Outlet) 100 Cubic Feet.
4·69 inches	13·34 gr.	0·151 gr.
3·10 ,,	14·31 ,,	0·265 ,,
2·00 ,,	15·28 ,,	0·420 ,,
1·50 ,,	11·01 ,,	4·150 ,,
1·43* ,,	24·05 ,,	0·673 ,,

* Apparatus partially bye-passed.

The following curve shows the connection between the amount of tar in the gas at the outlet of the apparatus and the differential pressure. The differential pressure is plotted as abscissæ, and



the tar at the outlet as ordinates. With respect to the temperature, the results show that this does not exercise as great an influence as might have been expected; and as great an efficiency was obtained at a low as at a high temperature. Although we

obtained these results, the temperature, according to other observers, should be kept about 80° Fahr., so that the tar remains thin and the plates clear themselves. A further point to be noted is that the amount of tar left in the gas at the outlet is independent of the quantity entering the machine, within the limits we worked at.

In conclusion, we might mention a few of the probable advantages to be derived from the use of such an efficient tar-extractor, when properly worked. The ammonia plant would be kept free from tar deposits and blockages, and be reserved for its proper function—the scrubbing of the gas and the elimination of the ammonia. The passage of a perfectly clean gas into the oxide has advantages which must be evident to everyone. The presence of tar in even small amounts is bound to clog up the oxide and render the contact of the gas with the oxide much less intimate. Thus with the cleaner gas the oxide would work for a longer time, and would foul up to a higher percentage of sulphur. There are many points in this connection which will occur to the members of the Institution; but we do not propose to go into these in detail here.

The effect of washing tar fog out with ammoniacal liquor as in the Livesey washer, and the effect of ammoniacal liquor on the phenols contained in the tar with its accompanying relation to the naphthalene trouble, we do not wish to discuss, as the matter has already been gone into by Professor White ["JOURNAL OF GAS LIGHTING," Nov. 7, 1905, p. 391], and is too big a subject for the present paper. In connection with the naphthalene question, we would call attention to the fact that at the present time the Pelouze and Audouin tar-extractor is being used for naphthalene extraction; the solvent being sprayed into the gas at the inlet, and in passing through the apparatus the solvent is brought into extremely intimate contact with the gas, and is removed along with the rest of the tar fog.

THE PURIFICATION OF WATER GAS.

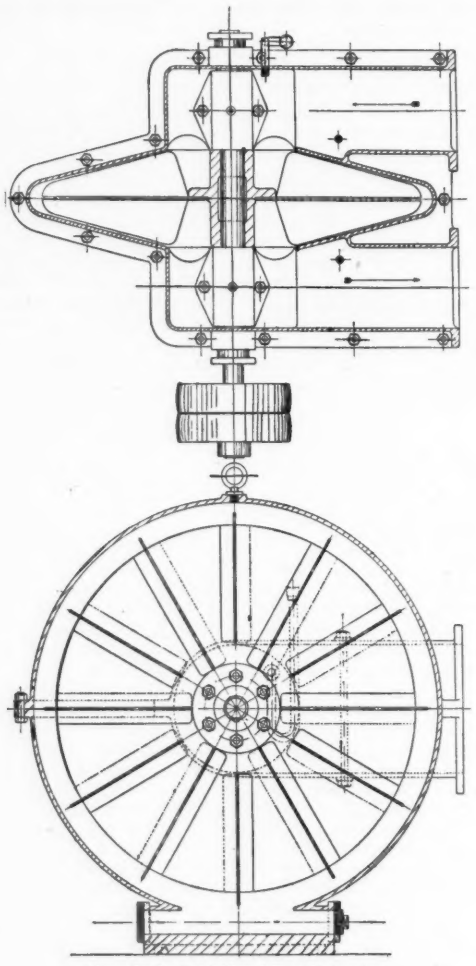
Having tested the Pelouze and Audouin tar-extractor on coal gas, and found the efficiency was all that could be desired, we next inquired into its applicability to water gas, and we accordingly arranged to test an installation just fitted up for a water-gas plant, and expected to be able to get some results from this source. When we had arranged to do the test, however, we found that the cage had gummed or pitched up, and this after only a few days working. Looking at the whole question from the results that were obtained from oxide used in purifiers, before which Pelouze and Audouin tar-extractors had been installed, we concluded that the present form could not give the desired result.

The purification of water gas presents much greater difficulties than the purification of coal gas; and in no case have we found oxide not contaminated with large quantities of tar, even when Pelouze and Audouin tar-extractors are in use. This fact led us to pass over the present form of Pelouze and Audouin tar-extractors as not sufficiently developed for water-gas purification. On considering the question, we came to the conclusion that the problem resembled very largely that which faced the producer gas industry, and crippled the efficient working of the large gas-engines, where the presence of tar pitches-up the valves.

In this case the gas must not contain more than about 0·1 gramme of tar per 100 cubic feet. We therefore inquired from these sources what had been the outcome of their investigations; and in all cases found that the second method of purification had been adopted—viz., purification by centrifugal force, Pelouze and Audouin tar-extractors having been tried and abandoned. All inquiries, however, failed to obtain any figures as to the efficiency of this system; and we decided to test it for ourselves. Two types of fan are in use—the ordinary fan and the Crossley fan. The difference in these two appliances can be plainly seen from the following description.

Ordinary Fan.—This type is the usual form used in blowing, and revolves at a high speed so as to get the desired centrifugal force; 1500 to 2000 revolutions per minute being the usual speed. The gas enters at the centre, and a jet of water is introduced at the same time. Both the gas, tar, and water are flung off at the periphery, and are separated after leaving the fan. In this type two or more are often employed in series, in order to get the desired result. The water used is 1 gallon per 80 cubic feet, or 12,500 gallons per million cubic feet, and the power required is about 15 H.P. The gas leaves the fan with an increased pressure of from 2 to 3 inches.

Crossley Fan.—This fan has been designed for the special purpose of gas purification; no attempt being made to increase the pressure of the gas, which leaves at the same pressure as that at which it entered. The fan consists of a revolving disc in a casing. The gas enters at one side, and in passing to the periphery absorbs much power. But this power is returned to the disc in the passage of the gas down the opposite side to the central outlet. Thus the total power absorbed is said to be very small—*i.e.* not more than 3 to 4 H.P. per 5 million cubic feet per day. It can readily be seen from the sketch that the tar particles, to get through the apparatus, must flow against the centrifugal action which has been imparted to them in order to again arrive at the centre and to pass out along with the gas stream. In this fan much less water is used than in the ordinary blowing fan as applied to gas purification. One gallon of water suffices to clean 1000 cubic feet of gas, or 1000 gallons per million. Water is only used to swill out the tar which has been deposited on the sides and prevent it clogging up the plant. The speed at which these fans



Crossley's Centrifugal Tar Extractor.

revolve is much less than in the case of the ordinary blower, on account of the construction, which allows a much greater peripheral speed for the same number of revolutions. The fan tested by us only ran at 400 revolutions per minute; the diameter of the disc being 9 feet, and the nominal capacity 5 million cubic feet per day. This is the largest size made; there being four smaller sizes. As regards the power absorbed in driving these fans (3 to 4 H.P.) we see from the following calculation that the horse power required for the fan is much the same as that necessary to drive the same volume of gas through a Pelouze and Audouin tar-extractor with a differential pressure of 4 inches.

Calculation of the Power required for a Pelouze and Audouin Tar-Extractor.

Let V = Volume of gas passed per minute.
D = Differential pressure in inches of water.
P = Pressure in pounds per square foot due to 1 inch of water.

The pressure to support 30 feet of water = 15 lbs. per square inch = 15 × 144 lb. per square foot.

i.e., pressure to support 1 inch water = $\frac{15 \times 144}{30 \times 12}$ lbs. per square foot, *i.e.*, P = 6 lbs. per square foot.

If we take the volume of gas to be dealt with as 4000 cubic feet per minute (*i.e.*, 5,760,000 cubic feet per day), and the differential pressure as 4 inches of water we get the following:

$$\text{Horse power required} = \frac{V \times D \times P}{33000} = \frac{4000 \times 4 \times 6}{33000} = 2{\cdot}9 \text{ H.P.}$$

In the testing of the fan, it must be borne in mind that the separation of the tar fog was effected in producer gas of ·8 specific gravity (referred to air as unity), and that as the specific gravity of water gas is only ·6, the advantage would be on the side of the water gas, and better results would probably be obtained on this material.

Tests on Water Gas.—The gas produced at two water-gas installations by Messrs. Humphreys and Glasgow were tested in order to ascertain the tar fog content immediately before the purifying plant. The results obtained are given in Table X.

TABLE X.

Works.	No.	Temperature.	Grammes of Tar per 100 Cubic Feet.
"A"	1	—	12·7
"A"	2	81·5	11·0
"C"	3	61·5	10·8

From these figures, one can calculate that for every million cubic feet of gas made 2·3 cwt. of tar deposits in the purifying material. This is equal to 42 tons per annum for a make of one million cubic feet per day. If we take the amount of sulphuretted hydrogen in ordinary water gas as 0·4 per cent. (which equals 16 grammes of sulphur per 100 cubic feet), we see that the amount of oil deposited in the oxide is almost equal to the amount of sulphur absorbed, which in fact, corresponds with many of our direct estimations in water-gas oxide.

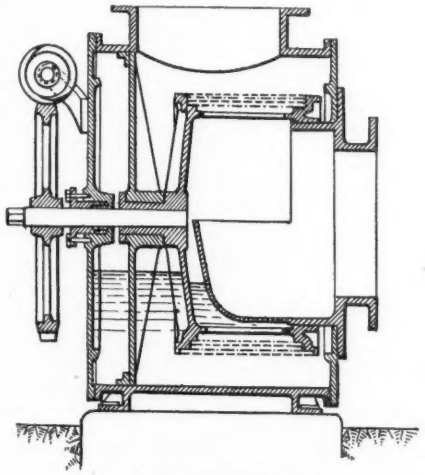
Tests on a Centrifugal Fan.—Having estimated the tar fog in water gas, and come to the conclusion that the solution of the difficulty seemed to lie in the direction of a centrifugal method, we made inquiries and found that this principle had not as yet been tried for the solution of this problem, but that everything pointed to a successful application of the method. Having no opportunity of testing these fans on water gas, we had to content ourselves with testing an installation working on the purification of producer gas. The fan was of the Crossley type, and had a nominal capacity of 200,000 cubic feet per hour. We were, however, only able to test it up to 100,000 cubic feet per hour, owing to the conditions prevailing at the time. The results of these trials are given in Table XI.

TABLE XI.—*Water Used on Fan, 30 Gallons per Hour.*

No.	Speed of Gas (1000 Cubic Feet per Hour).	Temperature.	Difference of Pressure.	Revolutions per Minute.	Tar (Inlet) 100 Cubic Feet.	Tar (Outlet) 100 Cubic Feet.	Purification, Per Cent.
1	60				3·8	0·426	89·0
2*	50	75° Fahr.	0	412	13·8	0·458	96·7
3*	50	84° ,,	0	412	26·5	0·690	97·4
4*	100	83° ,,	0·6 in.	400	9·36	0·570	93·9

* In experiments Nos. 2 and 3, the preliminary washers were bye-passed; and in experiment No. 4 one of the coolers was out of action, leaving more tar than usual to be dealt with by the fan. We see that the amount of tar at the inlet in experiments Nos. 2 to 4 is as great or greater than in the case of water gas.

On looking at these results, we see that the difficulty of the purification of producer gas has been overcome by means of this method of treatment; the last traces of oil being removed by sawdust scrubbers. If we assume—as there is every justification for doing—that similar results could be obtained on water gas, we should not only keep out about 95 per cent. of the tar at present entering the purifiers, but should separate this tar in a saleable form. As stated in the former part of this paper, the elimination of the tar fog from water gas would enable the sulphuretted hydrogen to be dealt with in all cases by oxide, and the use of lime for carbonic acid (if used) would become much more efficient in the quantity required per 1000 cubic feet. The carting away of the spent material, the saving in labour, &c., are large items to be taken into consideration.



Mallet's Rotary Tar Extractor.

Before concluding this small contribution on tar extraction, we should like to call attention to a rotary extractor invented by M. Mallet. This has the advantage of being self-cleaning—any deposits of tarry matter or naphthalene being washed off by the tar deposited in the apparatus itself; or, in case of necessity, a solvent can be allowed to flow through, as required. The arrangement is the outcome of the naphthalene trouble in coke-oven plant, where the condensation of the tar is very rapid, which probably causes the naphthalene to pass forward to an inconvenient extent and deposit in the ordinary type of Pelouze and Audouin tar-extractor. The plates are built up as a revolving drum, the lower part of which dips into condensed tar in the bottom of the casing. The regulation of the differential pressure is done by means of raising or lowering the tar level, but is not automatic. The optimum temperature of working is given as 80° to 85° Fahr.; and at 2½ to 3 inches differential pressure the efficiency is said to be a reduction from 13 to 6 grammes of tar down to 0·18 to 0·04 gramme per 100 cubic feet. This apparatus is in use in some gas-works on the Continent; but in England it has only, as yet, found application to coke-oven installations. As regards prices, all these installations come to about the same figure.

Discussion.

Mr. R. G. SHADBOLT (Grantham) said, thanks to the courtesy of the Secretary in providing the members with advance copies of the papers, he had had an opportunity of looking into the matter under discussion. In the first place, he wished to express his pleasure at seeing his old friend Mr. Niven again contributing to the proceedings of the Institution; and he only hoped the paper they had heard would be the forerunner of many valuable contributions from their older members, whose experiences often had an important bearing on the problems of the present day. He remembered that some eight or nine years ago Mr. Niven took a very strong line with regard to the necessity of removing tar fog; and he was glad to note that he still insisted upon it. It was very seldom that the members had two papers before them which were so complementary to each other; the two really fitted well together. Mr. Niven's contribution showed the consistency with which he had pursued the elucidation of the different problems by which he had been faced during his career. There were many other matters relating to the manufacture and purification of gas on which he had forestalled what had eventually proved to become very important inventions. But he (Mr. Shadbolt) should like to challenge Mr. Niven on one point, and that was with respect to modern works where, he would lead the members to believe, none but annular condensers would be found. He (the speaker) thought the tendency was to adopt water-cooled condensers, which, in his opinion, were more under control. He would guarantee that the valves would be found to be rusting fast when one wanted to use them; but the water-cooled condensers were much more effective. Having employed the two, his experience was—in frosty weather particularly—that by restricting the flow they could be worked better than atmospheric condensers. He did not know whether the author had had the extractor to which he referred in use sufficiently long to be able to give members the result of his working. If he had, it would supply them with some interesting information. No doubt what he (Mr. Shadbolt) was saying partook rather of the nature of asking for advice than offering criticism; but there was one thing he should like to ask the author, and that was what was the particular rule-of-thumb to which he referred with respect to the working of scrubbers and the use of water. The rule-of-thumb by which they were usually bound was the strength of the liquor—viz., the most profitable strength to make it if they sold it to a distiller. But, of course, there might be some other rule-of-thumb, with which they were not acquainted. He could not grasp what the author meant when he said (referring to the presence of ammonia): "This reaction is brought about by an elevation of the temperature of the gas which is passing through the purifier, such elevation being caused by some chemical change within the purifier, or by the increase in the temperature of the atmosphere without causing thereby a movement in the vapour tension of the ammonia contained in some other form than what is termed free." This seemed to read—though possibly it might not be so—that the vapour tension of ammonia was not subject to the ordinary laws of vapour tension. With reference to the 10 to 12 gallons of water used in the scrubber, of course a great deal depended on the quantity of liquor made. One thing which had struck him on perusing the paper was that if Mr. Niven was content with the results required by the Gas-Works Clauses Act, which specified the removal of the sulphuretted hydrogen only, why did he go to the trouble of taking out sulphur compounds? In the days when these had an effect on the illuminating power of the gas, this was a point which it was requisite to study; but at the present day, with the incandescent gas-mantle, it was a question whether "the game was worth the candle." Again, with regard to the statement about ammonia appearing in the purifiers, he thought this was not altogether an unmixed evil. He remembered on one occasion dealing with a bulk of oxide which became almost mud, and they could not get it effectively to work. The late Mr. Andrew Stephenson suggested that he should bye-pass his scrubber. He found that, by moistening with ammonia the oxide which had been previously dried, he could get double the duty from the sample which had been diluted. This corroborated the advice which had been given by Mr. Stephenson; and they got within a workable range of moisture. He found, even after this, that when the oxide began to flag, and particularly when it was getting near the spent stage, the addition of ammonia would liven it up. This went to show that a little ammonia in the purifier was not an altogether unmixed evil. With regard to what the author had said about changing his check boxes, he (Mr. Shadbolt) would like to know what happened when No. 1 became No. 2, with the last tier of clean lime and the tier before it of sulphided lime. He remembered once having to put in a bye-pass with four oxide and two check boxes; and he had to put in the

check boxes because the main valve was leaking. After having inserted the bye-pass, he found after an hour or two, as the carbonic acid came out, it seemed to drive the sulphuretted hydrogen forward; so that he used this as an indication of the state of the boxes. When it ceased to show, he knew that the sulphiding was not taking place. With regard to the question of moisture, of course a great deal depended on the word "consistency"—consistency of material, of treatment, and in general application; and with dry oxide one would get an equal distribution of the flow of gas if the boxes were filled in the ordinary way. They had found in recent years the benefit of the different devices which had been placed at their command for distributing the oxide lightly and evenly over the area of the box. He should like to know what the finished results of the author's methods were, so that they might judge of their efficiency. Mr. Niven very kindly allowed engineers to "paddle their canoes" in their own way, and work out their own ideas; but if he could give them the result of his system of working on the finished gas, it would possibly enable them to compare it with their own, and they might by this means effect an improvement. Turning to Messrs. Clayton and Skirrow's paper, that was a much more formidable matter; and he scarcely knew whether or not to tackle it. As he had already said, the paper was complementary to the other; and he believed, from what Mr. Niven had told them, it was a purely accidental circumstance that these two papers happened to be contributed at the same meeting. If this were so, he could only say it was a happy accident. Mr. Niven had pointed out the lifelong necessity of removing the tar fog; while, on the other hand, Messrs. Clayton and Skirrow came forward and told them for the first time exactly what the contents of the material were, and also indicated the methods by which they could be removed. The thought which remained in his mind, after perusing their paper, was that there was clearly some want of proportion. For instance, the writers approached the subject from a different point of view from that which they, as practical gas manufacturers, would approach it. As an illustration of what he meant, the writers commenced by telling them the percentage of tar which they had discovered in the sulphur abstracted from the spent oxide, and they said that it varied from 1 to 13 per cent.; whereas they, as gas makers, would say that it was ½ to 6½ per cent. of the spent oxide. The authors treated it as something deleterious to the manufacturer using up the oxide as the raw material; but it was a question to them whether it was so deleterious as was suggested. At any rate, if it were so, they were under an obligation to the authors for pointing out the way to remove it. Foreign matter, if it be inert to the extent of 5 or 6 per cent. in spent oxide, was not a very great thing to the practical-minded gas engineer; but, no doubt, there might be other things to be taken into consideration. He must congratulate the authors on the great care which they had exercised in obtaining samples of gas under constant conditions. He thought this, in itself, was a guarantee that the figures which had been given throughout as to the results of their tests were most reliable. Experimenters who took the trouble to decide the conditions under which their experiments should be carried out, might be relied upon to take great care over their tests. A glance through the tables furnished in the paper caused a certain amount of regret to be felt that the efficiency of the tower scrubber as a tar-extractor was not ascertained. This, to his mind, was minimized by the fact that such a low inlet content of tar fog was given as that contained in Table II., where it was found that the average inlet was only 1·5 of tar fog, as against others running up to 10 or 15. It occurred to one to ask what apparatus had previously effected this reduction. There had evidently been some plant in use which was fairly effective to begin with as an extractor of tar fog. It might have been a tower scrubber; but, on the other hand, of course, it might not. With regard to the coal-gas part of the paper, it seemed to him to resolve itself into a comparison between the Livesey washer and the Pelouze extractor. In some of the tables, the authors had run out some of their tests on the basis of the percentage of efficiency; whereas in others, for some reason or other, they had not. But by filling in the column of efficiency, and comparing the tables which were comparable, it would be found that the average percentage of efficiency under Table II. was 12·66; the efficiencies shown in Tables III. and IV., which referred to the action of the Livesey washer, were 86·60 and 86·70 per cent. respectively; while the average percentage of efficiency of Tables V. and VIII., dealing with the Pelouze extractor, varied from 55 to 99 and 97·20 per cent. in No. VIII.—showing a variation between 12½ per cent. in the case of the washer-scrubbers, and 98 per cent. in the case of the Pelouze extractor. Of course, he admitted that these figures were all arrived at under different conditions. The average percentage of efficiency of the Pelouze extractor at different pressures under Table IX. ran from 62·30 to 98·86 per cent., due to the varying pressures. The question here arose, to his mind, at any rate, as to whether tar-extracting apparatus of this or any other kind was to be judged on its percentage of efficiency shown between the inlet and outlet content, or upon its duty with regard to the quantity it might remove. The authors said distinctly that the amount of tar at the outlet was independent of the quantity entering the machine within the limits stated. He should like to ask whether the evidence which they produced was sufficiently conclusive on this point. He scarcely thought that it was, for these reasons: If Table VII. and Table VIII. were taken as an example, it would be found that the last two tests on Table VII. averaged 1½ per cent. of differential pressure with an outlet content of 4·15 grammes. With regard to Table VIII., the last two tests averaged 1·43 per cent. differential pressure with an outlet content of 0·673 gramme. This was a remarkable difference with practically the same inlet pressure. Then, again, Table VII. showed 62·30 per cent. of efficiency; while Table VIII. showed 97·20 per cent. Of course, the authors might be able to show that these comparisons were not made on a proper basis; and if they were not, he should be happy to be put right. This deficiency appeared still more contradictory when it was considered that in Table VII., with over six times the outlet content shown in Table VIII., there was less than half the inlet content. Therefore the statement that the outlet content was irrespective of the inlet content did not appear to him to be borne out. With the Livesey washer, the percentage of efficiency did seem to be the same with a variable inlet content. Yet here the outlet content was affected by that of the inlet with a greater inlet content. Although the percentage of efficiency might be the same, the outlet content was greater than where the inlet content was larger. Again, referring to Table VII., the author said that the efficiency of the machine fell off "regularly" with the pressure. He did not know whether this was not a slip of the pen; but, according to his reading, he should say that it ought to be "abruptly." It was certainly a great pity, with regard to these particular sets of tests, that the conditions were not such as to allow the authors to take a test at 3 inches pressure. It would be seen that the percentage of efficiency at 2 inches differential pressure was 97·2 per cent., which was almost as high as the percentage shown at 4¾ inches; and it was only when one came down to 1½ inches differential pressure that there would be any great falling off in the percentage of efficiency. He pointed this out simply as a reason for stating that the evidence brought forward did not appear to him to be sufficient to altogether support the statement that the outlet content was independent of the inlet content. The authors stated their results in grammes per 100 cubic feet of gas, which was an admirable thing to do in its way and for their purpose; but possibly it did not convey—certainly it did not to him, as a practical operator—that idea of the proportion it bore which some other forms of expression might do. This being the case, he had sought for some other mode of expressing it; and he had found roughly that a gramme per 100 cubic feet was really equal to a ton of tar per 100 million cubic feet of gas. So that it might be taken, to bring it more within their grasp, that in the case of works making 100 million cubic feet of gas, if there was in the finished gas or the gas entering the purifier, a gramme of tar per 100 cubic feet, it would amount to a ton in the course of the year. Looking at it from this point of view, and bearing in mind works making 100 million cubic feet as an example, and the figure of a gramme of tar per 100 cubic feet of gas made, they would find that, under the conditions of working shown in Table I., with the Kirkham washer, the 100 million cubic feet works would have a deposit of 28·8 cwt. of tar per annum. Under Table II., with the Kirkham and Clapham washer-scrubbers, the deposit would be 26·2 cwt.; under Table III., with the Livesey washer, it would be 29 cwt.; under Table IV., also with this washer, it would be 10 cwt.; under Table V., with the Pelouze and Audouin tar-extractor it would be 5·3 cwt.; and under Table IX., with different pressures, it would be from 3 cwt. to 83 cwt., which, of course, was a very great range of variation. To express it another way, one might say that with a 100 million cubic feet gas-works, using four 20-feet purifiers, and assuming that all the tar was deposited there, a content of a gramme of tar per 100 cubic feet would give a ton of tar; and on this basis the last result of the Pelouze and Audouin extractor, without subsequent assistance, would be 5·3 cwt. of tar deposit as its best result, with a layer in purifiers of 0·016 inch, as against, with the Livesey washer, a deposit of 8·8 cwt., with a layer in purifiers of 0·014 inch. This simply raised the question whether this efficiency was all that was to be desired or not. The question was whether this amount of tar affected their operations to such an extent that it was worth going to the trouble of removing it.

As the afternoon had now far advanced, Mr. Shadbolt paused here, and said that if it was the wish of the meeting, he would refrain from making any further observations at this point, and would "take up his parable" on the next occasion.

The PRESIDENT (Mr. W. Prince, of Stoke-on-Trent) suggested that it would be better if Mr. Shadbolt would put his remarks in the form of a paper. There would then be an opportunity for the members to make further criticisms on the papers now under discussion, which could be sent to the Secretary, and which would be duly published after having been submitted to the readers.

Mr. SHADBOLT said an entire meeting could be devoted to the discussion of this subject, which would be to the advantage of everybody.

The PRESIDENT said he was afraid there would be no opportunity for that.

Mr. J. H. BREARLEY (Longwood) said the papers they had just listened to were characterized by three very desirable qualities—they were full of practical ideas, they contained a large amount of originality, and, as Mr. Shadbolt had said, they could be discussed indefinitely. It was a pleasure to see Mr. Niven there to read his paper; and it was to be hoped that his presence signalized his complete restoration to health. It was perhaps a happy coincidence that it should come as a companion paper to one from Messrs. Clayton and Skirrow, seeing that the latter was upon a similar subject, and confirming, as it did, some of the conclusions which Mr. Niven had long held as to the desirability of entirely

removing tar fog before gas was permitted to enter the purifiers. The importance of this was only indifferently realized yet by a large number of engineers, who relied upon the scrubbers and washers, with the inevitable assistance of the purifiers, to entirely cleanse their gas from tarry matter. The tables given by Messrs. Clayton and Skirrow were of the greatest practical application, and bore evidence of a large amount of original work upon a fascinating subject. As Mr. Shadbolt had already pointed out, chemists, when dealing with the results of analyses, usually spoke of grammes; and the meaning which they bore when applied to actual work in bulk could not be realized except by calculation. For his own personal edification, he had calculated out what the results given meant upon the production of 100 million cubic feet of gas, and the weight in pounds of the tar recovered at the various points. He had not taken an approximate figure, but the actual weights; and the results he had obtained would be found embodied in the following table:—

Table.	Analysis Taken at—	Pounds of Tar per 100 Million Cubic Feet of Gas Made.	Based on—
I. . .	Outlet, Kirkham washer.	3175	The four tests (aver.)
II. . .	Inlet, washers.	3307	,, ,, ,, ,,
,, . .	Outlet, Clapham washer.	2866	,, ,, ,, ,,
,, . .	,, Kirkham ,,	2910	,, ,, ,, ,,
III. . .	,, Livesey ,,	3219	,, three ,, ,,
IV. . .	,, ,, ,,	1102	,, ,, ,, ,,
V. . .	,, P. & A. extractor.	584	,, five ,, ,,
VI. . .	Inlet, purifiers.	344	,, two ,, ,,
VII. . .	Outlet, P. & A. extractor.	333	First five ,, ,,
,, . .	,, ,, ,,	926	Next two ,, ,,
,, . .	,, ,, ,,	9150	Last two ,, ,,

It would be seen from the above table that the average of the first five tests in Table VII. taken at the outlet of the Pelouze and Audouin extractor was only 333 lbs. of tar per 100 million cubic feet of gas made. Looking at it from the broad basis of its effect upon samples of oxide, this did not appear to be very serious; but it was its effect upon purification that affected them, and it was because of this effect, he believed, that Messrs. Clayton and Skirrow, and also Mr. Niven, had brought their papers before the members. It was difficult, in papers bearing upon various kinds of apparatus, to eliminate names of firms; but if the practice was introduced at all, it should be followed throughout. The makers of the Pelouze and Audouin extractor (upon which their tests were carried out) were not stated, though the manufacturers of the other apparatus were indicated; and he thought the name of the former might have been included in the same way. He was surprised to hear the authors express the opinion that the temperature of a tar-extractor exercised little influence upon extraction, and that the efficiency was the same at low as at high temperatures. This was certainly not the experience of gentlemen employing other tar-extractors; nor did he think all engineers using Pelouze and Audouin extractors would endorse it. As to the use of tar-extractors in combination with an arrangement for spraying a solvent on the plates for the purpose of eliminating naphthalene, it would probably be found, with few exceptions, that the extractor itself gave sufficient relief. With the type of extractor to which Mr. Niven had referred, this had been found to be the case. He (Mr. Brearley) had come to the conclusion, from his own experience, that the tar-extractor would be a valuable remover of naphthalene, altogether apart from the introduction of a solvent. Of course, in a very serious case a solvent might be necessary in addition. He felt inclined to differ from Messrs. Clayton and Skirrow when they expressed the opinion (though, of course, they had made observations, and he had not) that the present form of Pelouze and Audouin extractor was not sufficient for water-gas purification. It appeared to him to depend upon whether a preliminary condenser was placed before the extractor. He knew that good results had been obtained in this way, though care was taken not to let the temperature of the gas get below 100° Fahr. Near the conclusion of their paper, the authors referred to a rotary extractor invented by M. Mallet; and it had been his (Mr. Brearley's) intention to ask what was the object of causing the plates as they revolved to dip into the condensed tar. But it had been explained that it was to wash the plates. Reverting to Mr. Niven's paper, he would like to ask what was the percentage of water which Mr. Niven found to coincide with his experience that "just sufficient to cause an adhesiveness of the oxide without percolating through the grates" was all that was required. In Mr. Niven's purifiers he used oxide of varying percentages of sulphur; and, from the way he put it, it was to be assumed that there was some method in doing this. Probably most, if not all, engineers used oxide of various percentages in the different boxes; but this was due to accident rather than any methodical idea. He would ask Mr. Niven if there was any method in his practice of varying the percentages to a certain scale; and, if not, whether he took care that the oxide in the several boxes should be of at least a certain difference in percentage.

Mr. S. GLOVER (St. Helens) said he would not take up time by going fully into the papers. He thought if Mr. Clayton had done nothing but emphasize the use of the Mallet tar-extractor, his paper would be of great value. It was well to introduce to their young men the possibility of having in operation a useful machine which would be far more efficient as a tar-extractor than a tower scrubber or any other sort of extractor. The removal of the tar, even when there might only be a ton a year of it in a make of 100 million cubic feet of gas, was an important matter, because its presence would go far to hinder the duty which would otherwise be done by the purifying material, and reduce its value. While thanking Mr. Niven for his paper, which one could have criticized if there had been time, he was sure that his object, which was stated very clearly, was a most worthy one. Mr. Niven said that in the process of purification all the impurities had to be dealt with; but some people preferred to shirk this task. They were advised to reduce the impurities to a minimum quantity, if they could not be altogether eliminated; and in attaining this end the tar-extractor would be of great assistance.

Mr. KENDRICK (the Secretary) announced that he should be very pleased to receive any criticisms in writing from the members, and forward them on to the readers of the papers. He wanted himself to say something on the subject of extracting the tar fog in connection with the water-gas plant; but there was no time to do so that day.

Mr. CLAYTON, on behalf of Mr. Skirrow and himself, thanked the members for their kind attention to the paper. He said their object was to put on record something more definite about tar-extractors than had hitherto been published. He thought, as the matter now stood, it was in the power of everyone to test exactly what his conditions were, and therefore he would be able to come to a better idea in the future than he had done in the past. Whereas the amount of tar in gas to be found in most of the well-conducted works did not make much difference, there were cases where the oxide contained tar in a very large quantity. It was pointed out in the paper that the presence of the tar must influence the purification. He had no oxide to look after, and therefore was not in a position to prove the suggestions he had put forward. He wished to thank the engineers of the gas-works who had so kindly allowed him to make experiments on their plants.

Mr. NIVEN also thanked the members for the patient attention they had given to his paper.

It was then arranged that the remarks that any other members wished to make on the papers should be communicated for publication in the "JOURNAL," and the authors be requested to reply later on to all the criticisms offered.

PERSONAL.

At the meeting of the Wolstanton District Council last Tuesday, Mr. A. A. T. BOTTELEY, the Gas Manager to the Leek Urban District Council, was appointed, out of six candidates selected from 110 applicants, Manager of the gas-works to be erected by the Council for the supply of gas in their district. The position is worth £250 per annum. Portions of the area of Newcastle-under-Lyme and Burslem, at present supplied with gas by the Corporations of these towns, are to be taken over by the new authority; and the other district to be served includes Silverdale and Chesterton—the latter town, having 7000 inhabitants, being practically without gas. The total consumption is expected to be 50 million cubic feet per annum, and to rapidly increase.

We regret to have to record the fact that Mr. JOSEPH JERVIS, the respected Secretary of the Eckington Collieries of Messrs. J. & G. Wells, Limited, has just felt it incumbent on him to resign his position—feeling that the weight of years and the length of his connection with the concern (some 57 years) entitle him to some relief from the anxieties inseparable from such a position as he has worthily filled, and in which he has made so many friends. Starting in a humble capacity, Mr. Jervis so fitted himself by close application to his duties as to eventually become entrusted with the Secretaryship of the concern with which he was identified on its being converted into a limited liability Company—some twenty years ago. In such a position he has necessarily become largely known to gas engineers, particularly in the Midlands; and they, as well as all who have been privileged to know Mr. Jervis, will wish him, after his years of strenuous work, a happy period of retirement.

The Forthcoming "Coalite" Flotation.

The "Observer" writes: "We are able to give some definite particulars of the British Coalite Company, Limited, the floatation of which is impending. It will purchase the patent rights for making and selling the new coal of which so much has been heard, together with sites and plant at Barking and Wednesfield, and an agreement under which Wm. Cory and Son, Limited, undertake to sell the 'Coalite' for 21 years. The Directors will include Mr. A. C. Cory-Wright, Sir William H. Bailey, of the Ebbw Vale Steel Company and the Manchester Canal, Mr. Albert Kitching, of the Metropolitan Railway, Sir W. H. Preece, and others interested in the coal trade. The capital will be £2,000,000 in 1,500,000 ordinary shares, entitled to a preferential 6 per cent., and to half the remaining profits, and 500,000 deferred ordinary shares entitled to the other half of the surplus profits. A profit of £500,000 a year is estimated from sales in the metropolitan area alone, without taking into account the profits on the valuable bye-products. The vendors will be 'Coalite Limited,' who will receive all the deferred ordinary shares and £100,000 in cash—the cash payment being to cover the deposits on the purchase of the land at Barking and Wednesfield, and the payment of preliminary expenses and underwriting."

LONDON AND SOUTHERN JUNIOR ASSOCIATION.

Visit to the East Greenwich Gas-Works.

Despite the bad weather of Saturday, between seventy and eighty members of the London and Southern District Junior Gas Association turned out to visit the East Greenwich Works of the South Metropolitan Gas Company—a description of which will be found in the "JOURNAL" for June 23, 1903, p. 891. The party were met at the governor-house by Mr. J. Tysoe, the Engineer-in-Charge, accompanied by Mr. White, his Chief Assistant, and others, to help in the imparting of information to the visitors. Particular interest was taken in the sulphuric acid plant and the sulphate of ammonia works. Mr. H. Austin, a workman Director, explained the machinery in the carpenters' workshops.

At the conclusion of the inspection, the party were entertained to tea, during which the President (Mr. W. Upton) proposed a vote of thanks to Mr. Tysoe for his kindness in giving up his Saturday afternoon to them, and to the South Metropolitan Gas Company for laying their works open to them for their instruction. He urged the members to study the problems of gas manufacture and distribution by continuous thought and application, for in that way only did progress lie. Their visit to East Greenwich that day made them think of one who was intimately connected with the Company—Sir George Livesey, who was an embodiment of talent, ability, driving force, and character. Mr. W. J. Liberty, the Vice-President, seconded the resolution; and it was supported by Mr. Walter Grafton.

Mr. Tysoe, who, on rising to acknowledge the vote of thanks, was received with acclamation, said that it had given him a great deal of pleasure to show the members over the works. It was a tradition of the South Metropolitan Gas Company that all and sundry who came were entitled to the fullest information—everything being open for their inspection. It had not been a wasted afternoon to him, for it had given him the opportunity of making the acquaintance of the members of the Association, of whose doings he had read much. Some of the older ones were passing away; and the young students of the present would be the men of the future. The works they had seen that day were a monument to the genius of Sir George Livesey.

The President said he had now a very pleasing duty to perform. They were at the works of a Company at whose head was "the first man in the gas industry"—Sir George Livesey—and he was about to propose that a telegram as follows should be sent him.

> "That this meeting of the London and Southern District Junior Gas Association, assembled at East Greenwich Gas-Works, desire to congratulate their patron, Sir George Livesey, on having reached his 73rd birthday, and wish him many years of useful activity."

Mr. Liberty, in seconding, spoke of the long and extraordinary career Sir George had had in the gas industry; he having heard Sir George tell how, in 1848, when Mr. John Thwaites, a draper in the Borough (afterwards Sir John Thwaites, the first Chairman of the Metropolitan Board of Works), started the old Surrey Consumers' Gas Company, now merged in the South Metropolitan Company, he (Sir George) was a mere lad working at the Old Kent Road works, under his father. This was when gas was 6s. per 1000 cubic feet, and competition was rife. Mr. Liberty also spoke of how, in the dark days of 1889—the year of the stokers' strike—Sir George brought the South Metropolitan Company through, and launched his great co-partnership scheme so successfully. He alluded to the vigour and personality of Sir George, and remarked that on all occasions he had something practical and helpful to say. In fact, it was only on his 73rd birthday, just past, that Sir George was addressing the men of these works in the boiler-house on his favourite topics—self-help and co-partnership. He was very glad to see one of the fruits of co-partnership present that afternoon in the person of Mr. H. Austin, a workman Director, elected by the men.

After the company had given three hearty cheers for Sir George, the telegram was sent.

Mr. Austin thanked the members for the kindly expressions used towards him; and Mr. Tysoe then informed those of the members who had not inspected all that was possible to be seen, that they were at liberty to wander round the works at their own sweet will. At a late hour the party broke up.

In a lecture recently delivered at the Royal Institution by Professor Church, on the preservation of stonework and mural paintings exposed to an atmosphere containing sulphurous acid, he protested against the action taken by Parliament, on the recommendation of Lord Rayleigh's Committee, in regard to the relaxation of the restrictions formerly imposed upon gas companies in regard to sulphur compounds. Our contemporary the "Builder" points out that the Committee were quite well aware that the presence of these compounds in the atmosphere is objectionable, and expresses the opinion that when an inexpensive and innocuous process for removing the whole of the sulphur from coal gas is invented, it will probably be speedily adopted. The writer goes on to remark that Professor Church recognizes that the most impure gas sent out by any London Gas Company, when used as a fuel in place of raw coal, sends into the air much less sulphur than would be emitted by the coal it has displaced; and that he should therefore rejoice that the use of gas as a substitute for coal is extending with great rapidity.

EVOLUTION OF THE INVERTED GASLIGHT.

(*Continued from p.* 587.)

Burner-Heads, Mixing-Tubes, &c.

In order that the mantle of an inverted burner shall glow uniformly, it is not only necessary to obtain a suitable mixture of gas and air in the tube, but also to see that a thoroughly non-luminous flame is produced, filling the mantle with the utmost accuracy possible. In the early days when upturned mantles were used for inverted burners, it was found that when the gas pressure was high the chief light came from the lower part of the mantle only; whereas when the pressure was low, only the upper part of the mantle glowed satisfactorily. The plan of inserting inside the mantle some finely perforated spreader to distribute the flame, which was adopted for upturned burners, proved unsatisfactory in the case of inverted burners, as the devices soon burnt out. Bernt and Cervenka tried using a perforated plate of steatite or magnesia; but it did not answer. Mr. Helps adopted a long burner tube, perforated laterally, and fitted with annular deflectors pointing obliquely upwards, so as to throw the flame against the mantle, while the products of combustion escaped through a circular chamber surrounding the injector. More recently Mr. Helps has introduced a burner in which a hemispherical mantle is slung as usual from the orifice, while above it two or more convex ring-shaped mantles are supported round the tube on collars of refractory material, which mantles are heated by means of flames escaping from radial holes in the burner-tube. Lehmann has designed a burner having hanging from its tube a hollow widened structure shaped like a mantle; the structure being divided by numerous partitions into chambers through which the mixture of gas and air passes on its way to orifices in the main wall, so as to play upon all parts of the mantle. Hardt, of Hamburg, has also invented a burner having its head composed of an enlarged perforated chamber of refractory material similar in shape to the mantle, which is carried from its ring on circumferentially arranged hooks in such fashion that the distance between the burner-head and the mantle is capable of adjustment (the best distance is said to be about 3 mm.). In Hardt's burner the position of the globe gallery is also adjustable so that the distance between the mantle and the perforated base of the globe can be altered. For employment with larger mantles, Hardt has modified his burner orifice, increasing its size, and placing below it a perforated plate. This arrangement is claimed to force part of the flame vertically downwards through the holes to the base of the mantle, while the rest escapes sideways and plays upon the upper part.

Most authorities are now agreed that the use of any perforated plate or wire gauze at the mouth of a burner is disadvantageous, not only because it is liable to burn through, but also because its presence hinders the production of a really steady flame. Modern inverted burners are therefore constructed without such devices; any gauze necessary to prevent the flame striking-back being situated within the tube. Moeller, of London, recently brought out a burner in which the gas is supplied to a ring-shaped tube, whence it travels through convergent pipes first disposed horizontally and then pointing downwards to the annular portion of a cylindrical burner-head, the central space of which is prolonged a short distance upwards, serving for the escape of the combustion products. The partition separating the annulus from the central space is partly conical in form; its lower extremity being slightly expanded, so as to give the issuing gas a divergent direction.

Numerous attempts have been made to construct high-power inverted lighting units with the aid of mantles arranged ring-fashion. Gefäll has introduced a burner in which the mixing chamber communicates through a narrowed passage with depending divergent channels of metal or refractory material terminating in two concentrically disposed ring-shaped apertures, interrupted at right angles by solid partitions. The mixture of gas and primary air escapes from the outer ring of orifices in an outward direction, and from the inner ring in an inward direction, so that it plays on both sides of mantles supported underneath the whole burner. The space within the inner ring of orifices is used as a channel for the escape of the combustion products. Clark, of Jersey, has designed a somewhat different arrangement, in which one large ring-shaped mantle is used, supplied with gas through numerous tubes issuing from an enlarged chamber on the common burner-head. Mr. Helps has invented a large inverted burner supplying numerous small mantles with gas from a common chamber, which is provided with a separate orifice for each mantle. The chamber itself is fitted with baffles, so as to give the mixture of gas and primary air a zigzag direction, and prevent the flame from striking back. A burner invented by H. Wolff, of Berlin, yields an annular flame; the tube terminating in a divergent hollow cone. The mantle is supported from pins inside the cone, so that the flame plays on both sides of the mantle simultaneously. Kiesler has brought out a burner with a widened mouth closed underneath by means of a perforated plate held in position by a screw. The plate is dished, with its convexity upwards; therefore the mixture of gas and primary air issues in convergent streams uniting some little way below the mouth.

The fact that burners with plain orifices used in conjunction with fairly long mantles tend to bring only the upper part of the mantle to its maximum degree of luminosity, has since led to the

introduction of numerous burners with narrowed orifices; the idea being to make the gas issue with rather greater force. When the plan is effective, the lower part of the mantle glows more brightly than it otherwise would do; but the upper part is not sufficiently heated, as photometric investigation shows. Apart from the irregular light-emission of mantles on burners having constricted orifices, a concentration of the flame upon the lowest part of the mantle tends to ruin it prematurely. Hence modern inverted burners are mostly made with wide outlets, being employed in conjunction with shorter mantles of larger diameter. When the burner is so constructed, photometric tests show that the mantle glows evenly all over. When the orifice of the burner has the same diameter as that of the mixing-tube, the mantle is not uniformly heated; and therefore Kay has proposed placing a collar round the mouth, so as to lead the flame on its upward path towards the higher portions of the mantle. He has also introduced a burner with a wide mouth, made by reducing the thickness of the walls of the parallel burner-tube, so as to form a shoulder inside. A further modification of the same plan is met with in the Kindermann burner, the tube of which terminates in a funnel-shaped enlargement.

The Auer Company, of Berlin, have replaced the ordinary parallel mixing-tube with a tube widened step-fashion, and fitted with a gauze and an orifice of refractory material; while Brooks fits a spherical enlargement containing a gauze on to his burner-tube, and gives it a constricted mouth. When a constricted mouth is employed, the length of the cylindrical portion ought not to be less than one-half the diameter of the enlargement on the mixing-tube. L. Wolff, of Berlin, has suggested constructing the mixing-tube of two symmetrical truncated cones arranged base to base; the idea of the upper cone being to diminish the friction of the passing gas, and of the lower one to increase its speed as it escapes from the mouth. In opposition to the plan adopted by the Auer Company, of widening the mixing-tube uniformly or in steps, Farnoff has introduced a mixing-tube decreasing in diameter from the injection chamber for half its length, and then suddenly widening again in two stages. According to him, if a coarse sieve is placed at the orifice of a tube so designed, the flame cannot possibly strike-back. Smith, of London, has also brought out a burner constructed on similar lines; the mixing-tube decreasing in diameter for a certain distance, and terminating in a pear-shaped enlargement containing a wire gauze.

The burners of the Kramerlicht Company were formerly constructed with cylindrical mixing-tubes and constricted outlets; but they now have tubes cylindrical in the middle, expanded at the top into a conical injection chamber, and also at the base, where they are fitted with gauzes and cylindrical mouthpieces of magnesia. The mantle in this burner is supported by three converging pins, which rest against projections on a ring attached to the burner-tube; while the globe is also fastened to a ring carried by bayonet joints from the deflector of the burner itself.

In most inverted burners, the primary air is introduced into the mixing chamber in the same fashion as is adopted for upturned burners, either through openings in the side wall of the chamber or in its base, so that the proportion of air entering is adjusted by merely rotating the ordinary collar or disc fitted with occasional holes. In order to prevent the flame striking-back at the moment of lighting, Ehrich and Grätz fit a gauze within the injection chamber between the nipple and the air-inlets; while Proskauer and Co. have a similar arrangement disposed cylindrically in an enlarged chamber. Eisner provides his injection chambers at one or more levels with numerous narrow slits, leaving only small portions of the metal continuous. This device also serves to restrict the transmission of heat from the lower part of the mixing-tube to the nipple. Regulation of the air supply is effected by a hit-and-miss arrangement at the top of the chamber. Inverted burners are apt to behave badly when they are erected in places where there is a draught. To avoid this defect, Shoob fits his burner with a conical injection chamber, having holes with protecting caps, and he arranges round it a spherical casing, the holes in which are at a higher level than the others. In a different arrangement the funnel-shaped inlet of the mixing-tube is surrounded with two spherical cases, with holes at different heights. Bernt considers it a better arrangement to fit a casing round and over his mixing chamber; the casing being provided with short lengths of horizontal pipe closed at their inner extremities, but perforated in their walls, so that the air travels round arcs of 90 degrees in an annular casing before entering the inlets of the injection chamber. Vis adopts an injection chamber with an upwardly projecting collar round the gas-pipe, the primary air entering through the annulus thus left. A screw collar on the gas-pipe enables the effective area of the annular inlet to be adjusted, while a finger on the collar allows the latter to be fixed at the proper place. Within his injection chamber, Vis places a gauze, to steady the air current.

Many devices that have been adopted in upturned burners, to ensure a sufficient proportion of oxygen in the mixture of gas and primary air, have been copied in inverted burners—such, for example, as the employment of several injection chambers arranged one after the other. In some of the earliest burners, the mixing-tube was surrounded by an approximately parallel jacket, by means of which a second supply of primary air was led to the flame at the point of combustion. Shoob has endeavoured to obtain a similar result by injecting some primary air close to the nipple, and providing a second row of inlets lower down and nearer the mouth of the mixing-tube. A practically similar device has been used by Jacob; a second row of inlet-holes being provided in the narrowed portion of the mixing-tube following the ordinary injection chamber, while a gauze is placed in a subsequent enlargement. One of these burners, consuming 100 litres of gas per hour at a pressure of 38 mm., has given an illuminating power of 75 Hefners—*i.e.*, has exhibited a duty of one Hefner per 1·33 litres. Compin has designed a burner with threefold air admission. The first supply enters through holes close round the nipple; the second, through holes in the top of an inverted cone placed round the mixing-tube, and thence entering the latter a short distance below; and the third, entering in the same way, and passing through an annulus down to the bottom of the mixing-tube. The mixing-tube of this burner is parallel; but a short length of pipe between the points where the first and second lots of air enter is used to constrict it, while the final orifice is also narrowed with a steatite mouthpiece. In all these burners, appropriate arrangements are made for regulating the quantity of air admitted.

(To be continued.)

WATER GAS TO SUPPLEMENT COAL GAS SUPPLY

A paper containing numerous reflections upon the best method of employing a water-gas plant for the assistance of a coal-gas undertaking was read by Herr Menzel, of Berlin, before the last meeting of the Silesian Association of Gas and Water Engineers, held at Görlitz. The report of the paper published in the "Journal für Gasbeleuchtung," gives the following particulars.

Herr Menzel remarks that a water-gas plant may be regarded from two distinct points of view by the coal-gas engineer; the water gas being considered either as a means of supplementing his make of coal gas or as a complete substitute for it on special occasions. The essential difference between the processes employed for making coal gas and water gas consists in the fact that the former must be carried out continuously, and in a section of the plant which is being worked to its utmost capacity; whereas the manufacture of water gas can be undertaken intermittently and in varying quantities. Hence the proper way to utilize a water-gas plant is to increase the amount of gas made in it as the days of autumn shorten, until a time arrives when the increase in consumption has reached such a point that it pays to bring into operation another setting or another retort-house in the coal-gas plant, when the manufacture of water gas is again reduced to a small amount. According to most coal-gas engineers, the production of water gas is only cheaper than that of coal gas when the former does not need enrichment; and they also consider that when the plan of auto-carburation is adopted, from 10 to 15 per cent. of water gas can be added to the coal gas without appreciably injuring its quality. Auto-carburation is the proper process to use when irregularities in consumption do not exceed 10 to 25 per cent. If larger amounts than these have to be added to the coal gas, the water gas must be carburetted by the hot process; but when smaller additions suffice, cold carburation by means of benzol vapour is preferable.

Occasionally, some special circumstance may arise when it is extremely convenient to have facilities for replacing a supply of coal gas by water gas altogether. For example, a strike among the men, or a breakdown in the coal-gas plant may occur, or there may be delays in procuring further supplies of coal. It is not always desirable for a gas undertaking to keep large stocks of coal. The capital locked up in such supplies is a serious item, and the deterioration of the coal during storage has also to be considered. On the other hand, large stores of coke may always be kept, for coke does not appreciably deteriorate on storage, especially when it can be kept under cover. Moreover when arrangements are such that the manufacture of coal gas can, if necessary, be altogether abandoned for a short time, it is not requisite to keep correspondingly large stores of coke always on hand; because when the crisis is approaching, the sale of coke can always be stopped, and the whole of the material, which is produced as the coal on hand is carbonized can be afterwards employed to make water gas. When it is anticipated that the production of coal gas may have to cease altogether, the water-gas plant must comprise oil carburetting apparatus. Water gas, of course, can be enriched with benzol; but as it contains hardly any methane, it will not carry enough benzol vapour to have the same illuminating power and calorific value as ordinary coal gas. So long as the water gas is simply regarded as a material to be added to coal gas, a choice between the cold and hot processes of carburation will depend on the relative prices of benzol and of gas oil; but if water gas is ever to be supplied alone, the hot process of carburation is indispensable. Thus the best method of installing water-gas generators on a coal-gas works consists in fitting the plant with such apparatus and connections that either blue water gas or oil-carburetted water gas can be made, and that the blue water gas can either be admitted to the coal-gas retorts at the proper times in order to achieve auto-carburation, or can be loaded in the cold with benzol vapour. This certainly is the ideal arrangement; but so complicated a system is not always necessary.

At the end of his communication, Herr Menzel mentioned that a Dellwik-Fleischer water-gas plant had recently been erected at

the municipal gas-works at Görlitz. At the time only blue water gas was being made, which was passed directly into the coal-gas retorts. It had been found that this method of auto-carburation resulted in a much smaller production of retort carbon, and that owing to the dilution of the coal gas with the water gas, naphthalene stoppages in the plant and the distributing system were far less common than heretofore.

GAS SUPPLY UNDER PRESSURE.

The current number of the "Journal de l'Eclairage au Gaz" contains an account of a successful experiment in supplying gas under pressure carried out by the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz for the Compagnie Provinciale des Eaux, du Gaz, et de l'Electricité (E. Borias et Cie.), the concessionaries for the supply of gas to the town of Guérande, on the west coast of France. The latter Company undertook last year to furnish a supply of gas to the bathing-place of Pouliguen, about 4½ miles from Guérande; and the question arose as to whether they would put up small works for the purpose on the spot, or send a supply of gas under pressure from those already existing. In the result, the latter plan was adopted; and it was decided to erect a holder only at Pouliguen. Apart from its economy, there was the advantage that this plan would utilize the works at Guérande at a time when the local demand for gas had fallen off—viz., in the summer months.

The gas from the Guérande works is driven by means of compressors through a comparatively small main to Pouliguen, where it is stored in the new holder, which is of about 10,500 cubic feet capacity. The distributing mains start from the outlet of this holder, and the gas reaches the town after passing through an ordinary governor, regulated to a pressure corresponding to the requirements of the population. As Guérande lies about 140 feet higher than Pouliguen, the gas has to be forced downwards. The main between the two towns is an ordinary 3-inch cast-iron one; and it is stated to be quite satisfactory from the point of view of tightness. The gas-pumping station at Guérande comprises a meter of about 70,000 cubic feet capacity, for recording the volume of gas, which on leaving it passes to the pumping plant. This consists of two Roots No. 3 fans, belt-driven by two "National" gas-engines, each of 1¾ H.P. The plant is in duplicate, so as to have a compressor and an engine in reserve; but one engine and a fan suffice. The inlet-pipe to the gasholder has upon it a special valve which automatically closes the main when the holder is full. When the valve has been closed, if the compressing plant continues at work, the increased pressure of gas in the main causes a hydraulic safety-valve to come into operation until the engine and fan are stopped. There is, however, a private telephone between Guérande and Pouliguen, which is utilized to transmit electric current to an alarm-bell and level indicator, so that the Manager at the works knows exactly the height of the holder.

The diameter of the outlet main from the Guérande holder is 5 inches, and 4 inches at the inlet and outlet of the fans. With a gas-engine using about 42 cubic feet per hour, 1600 cubic feet of gas are pumped per hour; the pressure at the inlet to the fans being 3 inches, and at the outlet 22 inches, except at starting, when it rises for a moment to 25 inches. At 50 inches pressure, the fans could deliver about 2500 cubic feet of gas per hour. This variability in production led to the adoption of the fans in preference to ordinary exhausters.

VIGNON'S GAS-MAKING PROCESS.

A patent has lately been taken out by M. Léo Vignon for producing a gas suitable for lighting and heating, by causing a mixture of carbon monoxide, hydrogen, and steam to react, in certain proportions and at a suitable temperature, upon iron and its oxides. The reaction is exothermic, and theoretically does not use up heat; 8 volumes each of carbon monoxide, hydrogen, and steam giving 16 volumes of hydrogen and 8 volumes of carbonic acid. The iron acts as a contact substance, carrying the oxygen of the water on to the carbon monoxide. Other contact substances, especially platinum, produce the same action. Practically oxidation of the carbon monoxide is limited; but transformation easily reaches two-thirds of the carbon monoxide in the reaction.

In working the process, it is started with water gas. A mixture of this gas, formed of about equal parts of hydrogen, carbon monoxide, and steam, is conveyed on to fragments of iron placed in a retort heated to redness. Oxide of iron is formed by decomposition of the steam, and destroyed by the oxidation of the carbon monoxide. Supposing oxidation of the carbon monoxide is total, the product of the reaction is formed of 66 volumes of hydrogen and 33 volumes of carbon dioxide for 66 volumes of water gas utilized. This gas is afterwards freed from carbonic acid by a solution of carbonate of potassium, or by any other means. Finally, starting with a certain volume of water gas, a volume, at least an equal of hydrogen gas, yet containing a certain proportion of untransformed carbon monoxide, is obtained.

The advantages claimed for the gas thus secured are the following: (1) Greatly diminished toxicity, owing to the disappearance of a considerable quantity of carbon monoxide. (2) More efficient carburetting by benzine, if the gas is to be utilized for lighting; the same weight of benzine per cubic metre producing a higher illuminating power with the new gas than with water gas. (3) Neither the initial volume nor the calorific power is lowered. The gas thus obtained can be employed for incandescent lighting and also for heating. If for lighting, it can be carburetted by benzine or petroleum vapour, by admixture with ordinary gas, acetylene, or any other combustible gas.

EXTENSION OF THE TORPOINT GAS-WORKS.

Since the reconstruction of the Torpoint Gas Company, Limited, the question of the extension of the works has been receiving the attention of the Directors; and last Wednesday there was a representative gathering to witness the inauguration of new carbonizing plant. Though separated from Devonport by the broad reaches of the Hamoaze, Torpoint is really a suburb of the borough; and of late years it has considerably developed. It had, in fact, grown to such an extent that the old Company were unable to meet the demand for gas; and, with the object of raising the needful capital, the present Company was formed and acquired the undertaking. Mr. James G. Clark, the Engineer and Manager of the Newton Abbot Gas-Works, was consulted; and under his supervision the works have been remodelled. The height of the retort-house has been raised by 13 feet, and a new iron roof has been put on. The additional height has given space for the installation of a regenerative setting, which occupies half the house; the intention being to replace the remainder of the old benches with new retorts on the same plan when the demand renders further extensions necessary. Messrs. R. & G. Hislop, of Paisley, were the Contractors for the erection of the retorts; the ironwork being supplied by Messrs. Willey and Co., of Exeter. At present two arches have been built. The setting completed is one of four retorts, though there is space in it for six. In describing the installation, Mr. Clark said that though it was on a small scale it would yield as good results per ton of coal as those of larger works, and perhaps better. It was the first of the kind in Cornwall. They could rely upon first-class yield from the coal, good heats, small fuel consumption, and no waste of fuel in the ash-pan. The heat was easily controlled, and the setting could be shut off at night, if necessary, with no loss of heat in the morning. The four retorts would produce with ordinary charges 20,000 cubic feet of 15½-candle gas per day. This yield could be increased to 30,000 cubic feet or more if necessary, compared with only 13,000 cubic feet from the old setting; and the make per ton of coal would be from 10,000 to 10,500 cubic feet, against 6000 cubic feet. As the highest consumption at present was only 17,000 cubic feet, there was ample margin for the future growth of the business. Adjoining the retort-house a new engine-house has been erected, containing a 4-H.P. Crossley gas-engine and a combined exhauster, bye-pass, and governor by Messrs. George Waller and Son. A new gasholder with a capacity of 17,000 cubic feet, in a steel tank, was erected by Messrs. Willey and Co. three years ago; and the old gasholder tank is being covered for use as a tar and liquor well. The alterations to the retort-house and engine-house have been carried out at a cost of about £1000.

The Inaugural Ceremony.

The Chairman of the Directors (Mr. W. J. Waycott) formally started the new plant. He said the gas supply of the district had been a source of anxiety for the past few years; but the steps now taken would ensure a plentiful supply. The works were erected fifty years ago, and up to a few years since no great changes had been called for. Now, however, the town had grown considerably, and in the extensions which had been made they had provided for the future to such an extent that, if necessary, four times the present quantity of gas could be sent out. They were determined that the supply should be as efficient and as cheap as that of any other town of similar size in the country. There had been cause for complaint with regard to the supply of gas in the past; but in future there would be no scarcity.

The Directors afterwards entertained at luncheon a large party, which included the members of the District Council. Mr. T. E. Reynolds, in proposing the toast of "The Gas Company," remarked that although there had been grumbling at the price of gas, they had been bound to recognize the fact that the shareholders of the old Company had not received any dividends for several years. They hoped now that better days were in store for the Company, and that both the shareholders and the consumers would benefit. He complimented the Secretary and Manager (Mr. Ernest F. Clear) on the way in which he did his work, and met the representatives of the town. Mr. W. H. Terrell, one of the Directors, in reply, said he should be glad to support a reduction in the price of gas when it was possible to make it. Mr. Clark, on behalf of the contractors and himself, presented a silver rose-bowl to the Chairman, as a *souvenir* of the occasion. He said he had taken the responsibility of advising the Company to spend £3000 or £4000 on the improvement of the works; and he thought the results would justify it. The number of consumers had increased from 100 to 330; and there were 200 cookers in use. The consumption had increased by 2 million cubic feet; and the leakage had been reduced from 54 to 11 per cent. Though the advance in the price of coal would add largely to the cost of the production of gas, he anticipated that the economy which would result from the use of the new plant would enable the Company to meet this extra outlay and pay a dividend of 5 per cent. The Chairman, in acknowledging the gift, said the Directors owed a duty to the shareholders as well as to the consumers, and they hoped to satisfy both. He was desirous that the price of gas should be reduced at as early a date as possible.

REGISTER OF PATENTS.

Filtering Gas.

ROBERTSON, J., of Deptford, and WILLANS AND ROBINSON, LIMITED, of Rugby.

No. 19,624; Sept. 3, 1906.

Gas (and especially producer gas) is commonly filtered, the patentees say, by passing it through a filter or scrubber having in it trays containing filtering material—such as wood, shavings, sawdust, or the like. According to their "invention," the material in one or more of the trays and preferably in the last tray of the series is covered with a screen of textile material—such as ordinary blanketting—which will prevent any particles of liquid or solid matter from passing, and "will compel the gas to distribute itself evenly in the different portions of the scrubber."

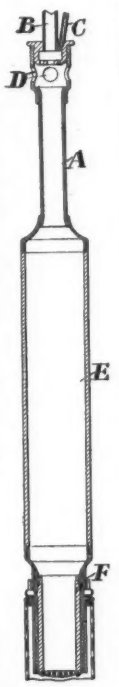
Incandescent Gas-Burners.

FLEISCHHAMMER, F. O., of Altona, Germany.

No. 14,368; June 22, 1906.

This invention relates particularly to high-pressure inverted burners of the type in which the gas and air mixing tube is made up of three different sized portions—the upper short mixing tube or inlet of smallest sectional area being separated from the outlet or burner head of intermediate sectional area by an enlargement of largest sectional area. The invention consists in making the combined area of the gas outlet openings in the burner head or crown plate of such a burner equal to the cross sectional area of the upper short mixing tube or inlet.

The gas enters the inlet-part A, through the central nozzle B, while air under pressure is admitted through the adjacent nozzle C. These two nozzles open into the preliminary mixing-chamber. Through the bottom openings of this chamber the mixture of gas and air enters the first and narrow part of the burner-tube, where still more atmospheric air is admitted through the side-openings D. From the inlet the mixture of gas and air passes into the middle and widened part E, and then into the outlet tube F, the sectional area of which is smaller than that of E, but larger than A. The outlet is closed by a perforated bottom-plate, through the holes of which the mixture of gas and air passes to the flame. The number of the apertures in the base-plate is such that the sum of the sectional areas of the apertures will be equal to the sectional area of the inlet. The outlet is enclosed by a sleeve of asbestos surrounded by a metal sleeve to which the mantle is attached.



Fleischhammer's Incandescent Inverted Burner.

Manufacture of Coal Gas.

PARKER, E., of Levenshulme, near Manchester.

No. 16,471; July 21, 1906.

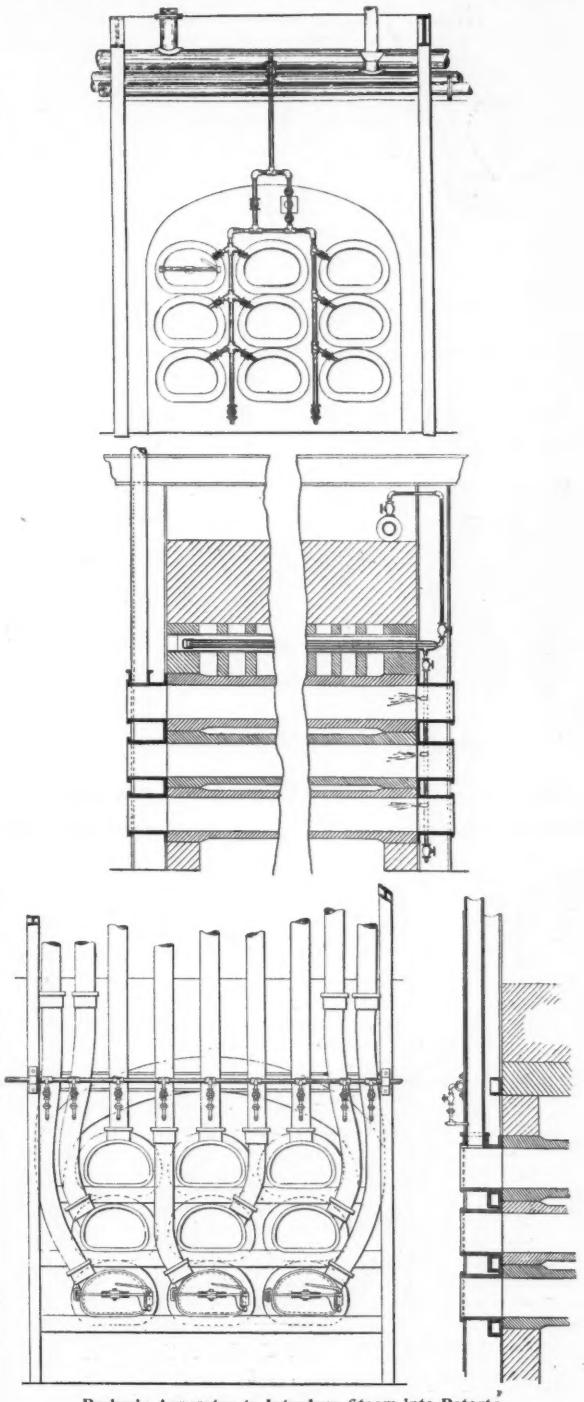
Beginning his specification, the patentee says: "In the manufacture of illuminating gas from coal it has been proposed to introduce steam into the retorts for the purpose of increasing the yield of gas and ammonia, and also along with liquid hydrocarbon for the purpose of enriching the gas and forming ammonia. It has been common in such cases, however, to permit the steam to pass through the coal, thereby decomposing the steam and forming water gas which is not the object I have in view, as I desire to so introduce the steam that it will not be decomposed but will pass through the retort with the hydrocarbon gases and condense out again in the ascension pipe and hydraulic main. I find that if a retort be worked in the ordinary way but under a high vacuum (say, of about 6 inches water gauge), while the yield of gas may be quicker, a great quantity of naphthalene is produced and deposited by the decomposition of the hydrocarbon gases owing to the greater heat; and it is to prevent this formation and deposit of naphthalene when working under a high vacuum that my invention is designed. I find by my experiments that, by introducing steam into the retort in such a way as not to pass through the coal but only to pass over the surface of the coal and mix with the gases and prevent the gases coming into direct contact with heated surfaces of the retort that the gases are protected, that their decomposition and formation of naphthalene is prevented, and that the yield of gas and the production of ammonia is greater."

The illustrations show a longitudinal section of the invention applied to horizontal retorts with the steam pipes applied to the back of the retorts, and an elevation of the same from back; also a sectional and front elevation of the steam pipes applied to the ascension pipes.

The retorts (either horizontal or inclined) are constructed with gas take-off or outlet pipes at one end only. At the back of the retort a pipe is inserted as near the top as possible through which steam is introduced above the level of the coal in the retorts so as to pass along above the surface of the coal from one end to the other and pass out at the off-take. The steam so introduced is not decomposed but, mixing with the gases as they are generated, "protects them from contact with the heated surface of the retort and prevents their decomposition."

Dry steam is said to be preferable as it is less liable to decomposition. For the purpose of drying the steam a superheater may be set in the furnace above or below the retorts through which the steam will pass before injection.

The gas is drawn off by the ordinary exhausting apparatus but operated so as to create a high vacuum which increases the yield of gas and also prevents the contact of the steam with the coal and consequently prevents the decomposition of the steam and the formation of water gas. "The steam thus mixing with or surrounding the gases prevents their decomposition and the formation of naphthalene and condensing in the ascension pipe prevents the choking up of the ascension pipe and the free passage of the gases therethrough. The presence of steam in the ascension pipe prevents dryness therein and reduces the coating on the internal surface of the pipe and the consequent choking." Steam may also be admitted direct to the ascension pipe by inserting a steam pipe in it as shown.



Parker's Apparatus to Introduce Steam into Retorts.

Gas-Generating Plant.

CHARLOUIS, M. D., of s' Gravenhage, Holland.

No. 24,833; Nov. 5, 1906.

This invention relates to plant which comprise gas-generators, dust-catchers, scrubbers with coke and saw-dust, or the like, and sucking devices adapted to produce a draught throughout the several parts, so that air is sucked into the generators, and gas is sucked from the generators through the dust-catchers and the scrubbers. The plants may be arranged either for turning all the tarry matters at once into gas, which is mixed with the generator gas, or for recovering the tars formed.

Gas-generating plants hitherto (the patentee remarks) present the defect that the gas on its way from the generator to the scrubber filled with coke is condensed, "so that it cannot be thoroughly or economically cleaned and cooled." The reason for this defect lies in the fact

that the pipe or passage through which the gas passes from the generator to the scrubber is too long and too narrow. His invention therefore consists in placing the generator and scrubber near each other, and at their bottoms they are connected with one another by a communication the area of which is made much larger than hitherto, so that the gas during its passage from one vessel to the other will not be condensed, and "can therefore be more thoroughly cleaned and cooled in the scrubber than hitherto."

Temperature or Pressure Actuated Valves.

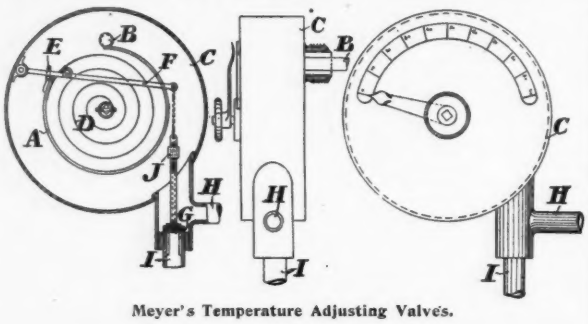
MEYER, J. H., of Brussels.

No. 25,405; Nov. 10, 1906.

This invention is a device for automatically retaining any air, liquid, or mass heated in a room or a receptacle at a predetermined, adjustable temperature.

In the example shown, the closing device is utilized to keep the temperature of a liquid heated in a receptacle constant by interrupting the admission of gas to a burner arranged below the receptacle after the desired temperature has been reached.

The spiral spring or tube A is connected with a pipe B, which enters with its closed end the receptacle containing the liquid to be heated, to which receptacle the casing C is attached by means of a threaded nipple. To the free end of B the solid spiral spring D is attached, which in turn is secured to a spindle arranged at the centre of the casing. Outside the casing a pointer is connected with the projecting spindle end, and may be suitably set upon a scale. During this setting operation the hollow spiral spring will be tensioned accordingly. The free end of the spring A carries an eye E, which takes hold of a lever F, hinged to the inside of the casing in such a manner that the cut-off valve G suspended from the free end of the lever will be opened when



Meyer's Temperature Adjusting Valves.

the hollow spiral spring is put under tension, so that the gas admitted by the pipe H can flow through the pipe I to the burner arranged beneath the receptacle (not shown). As soon as the liquid contained in the latter has reached the predetermined temperature, the spring A will have been sufficiently straightened under the influence of the created inner pressure to close the valve G. For feeding a pilot flame suitably connected with the burner, the hollow valve-spindle is provided with an aperture or slot the opening through which to the hollow valve spindle may be increased or diminished by the adjustable nut J. In order to obtain a uniform guidance of the spiral spring, the end of the solid spiral spring may be guided by a roller.

The scale is graduated to indicate degrees of heat lying between 0° and 100°; but the device may be used for lower or higher temperatures. Likewise the valve G may be so adjusted that during the normal position some gas may pass.

In a modified form the device may be employed to regulate the temperature of a room, heated from a source of heat independent of the device, so as not to rise above a given temperature. In this case the device would act upon adjustable and balanced air-valves instead of acting upon a cut-off valve, which air-valves would open and admit fresh air to the room as soon as the predetermined temperature should have been reached. In such a case the dimensions of the device would, of course, be regulated to suit the dimensions of the room. Besides this the device may also be employed as a reduction-valve for steam conduits and similar purposes.

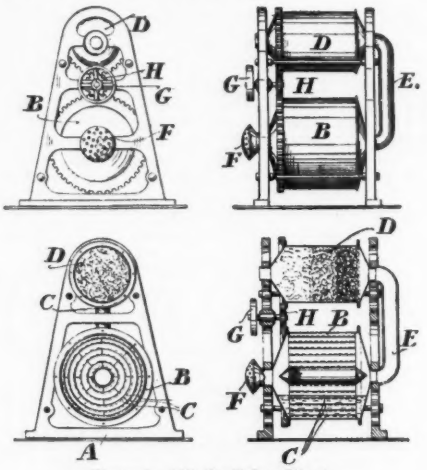
Gasifying Oils and Carburetting Air.

KURZER, L., of Dresden.

No. 26,698; Nov. 24, 1906. Date claimed under International Convention, Nov. 30, 1905.

This invention relates to a device for gasifying heavy carburetting oils, in which the oil to be gasified is continually distributed to large rotating surfaces and so brought in contact with the air to be carburetted. The device consists of a rotatable gasifying drum preferably provided with inner concentric pipes or cylinders, the outer surfaces of which are coated with layers of absorbing material (cloth or the like). With the drum there is connected a purifying and "post-gasifying" drum which rotates at the same time with the other drum. The drums may be brought in connection by a conducting-pipe or be arranged within a common case and on one driving shaft.

The gasification takes place within a drum B, which (in horizontal position) is rotatably mounted on a framework or support. The drum includes a number of concentric cylinders C concentrically arranged around the axis of the drum; and by narrow cross-pieces, the cylinders are rigidly kept in position. The outer surfaces of the cylinders are coated with layers of (say) cloth. Within the lower part of the drum is the oil to be gasified. The ends of the innermost cylinder C are closed by conical covers. The trunnions are longitudinally channeled, so that they form the inlet and outlet openings. Above the drum B there is also rotatably mounted the purifying and post-gasifying drum D. It is filled with stringy material—such as loofah or the like—preferably in two or more layers. The trunnions of this drum are also channeled; and one of the trunnions is connected with one of those of the gasifying drum by a pipe E. The other free trunnion of the latter drum, which is protected by a sieve F, serves as air-inlet.



Kurzer's Oil Gasifying Plant.

To the free trunnion of the purifying drum is attached the apparatus for sucking off the air-gas and conducting it to the motor. The air to be carburetted is so sucked through the sieve F into the gasifying drum where it passes between the oil-saturated surfaces of the cylinder C. The drum B is in rotation during this action so that the air-draught continually meets fresh oil-saturated surfaces.

The drum is driven by a pulley G mounted in the framework. The shaft of the pulley bears a cog-wheel H, which engages a cog-rim on the circumference of the drum B. At the same time it engages also with a cog-rim on the circumference of the purifying drum D, so that the latter is at all times rotated at uniformly the same speed as the gasifying drum.

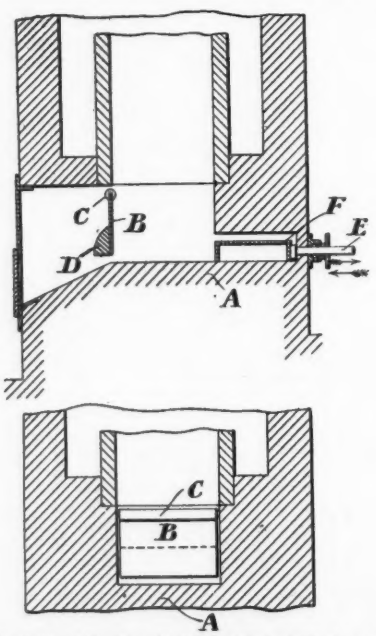
The carburetted air flows from the latter into the pipe E, and thence into the drum D. Here any drops of oil brought over from the gasifying drum are separated by the stringy material. Since the drum is rotating the oil-particles have not time enough to fall down; but they are continually brought into the draught of the air-gas, and thus must also be gasified.

Discharging Inclined or Vertical Retorts.

WOODALL, H. W., of Wimborne, and DUCKHAM, A. M'D., of Upper Parkstone, Dorset.

No. 2981; Feb. 6, 1907.

In retorts either inclined or vertical—in which the charge is carried by a support fixed at a short distance from the bottom, and the spent charge is discharged from the support by means of a pushing device—



Woodall and Duckham's Vertical Retort Discharger.

unless the superficial area of the support amply overlaps the sectional area of the bottom of the retort, the patentees point out, "an extra amount of spent charge above that actually pushed will sometimes be discharged, because it runs off the support of its own accord." Also, "in setting a number of retorts in one bed, it is inconvenient to make the bottom supports of any considerably greater area than the sectional area of the bottom of the retorts, as the bed would then occupy more space than would otherwise be necessary." According to their

present invention therefore, they provide a flap at about the edge of the support, and of such dimensions, and so weighted, that it will only allow such quantity of spent charge to be discharged as is actually propelled by the pushing device.

In the mode illustrated of applying the invention, at the discharging end of the support A is a flap B hinged at C and weighted at D; the flap forming a support for one side of the column of spent charge resting on the support. As the pusher F (given a reciprocating movement by the rod E) moves towards the flap the latter moves under pressure of the spent charge thrust against it by the pusher and allows the spent charge to be discharged from the support (to be afterwards removed as may be convenient). The flap may be made in several pieces connected by horizontal hinges so as to give it a certain amount of flexibility; and, if desirable, the flap may be formed of any number of vertical pieces swinging independently of each other.

APPLICATIONS FOR LETTERS PATENT.

11,731.—WILSON, H. F., "Lock-taps for stoves." May 21.
11,734.—JOHNSON, H. H., and MOIN, E., "Lighting and extinguishing gas-lamps." May 21.
11,768.—HUDLER, J., "Incandescent gas-lamps having horizontal burners." May 21.
11,804.—WINTON, A., and ANDERSON, H. B., "Carburettors." May 21.
11,847.—THOMPSON, J. W., "Governor for exhausters." May 22.
11,918.—LJUNGSTRÖM, B., and FORSBERG, E. A., "Gas-turbines." May 22.
12,034.—SUTTON, C. J., "Packing inverted mantles." May 24.
12,063.—LJUNGSTRÖM, B., "Gas-turbines." May 24.
12,130.—CATTEAU, J. B., "Suction-gas producers." May 25.
12,153.—BRETT, C. G., and HENNEBERGER, F., "Adjustable jets for air-gas burners." May 25.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Early Gas Literature.

SIR,—I much appreciate Mr. Brackenbury's very kind remarks on my bibliographical efforts, and fully endorse his opinion that the library of the Institution of Gas Engineers should contain all and everything published relative to gas engineering and the industry generally.

Probably every gas engineer and manager has his library of modern gas books, &c.; but very few are able to obtain even a small sprinkling of the early works. Hence it would appear most desirable they should be collected into one centre; and what more fitting centre can there be than the library of the Institution of Gas Engineers? I would not for one moment suggest that the Institution should relax its efforts to obtain modern works; indeed, not only should the authors and publishers of new books in England be encouraged to present copies to the Institution, but it is quite within the bounds of possibility that copies of all foreign books and periodicals (of which there are so many) referring to the gas industry could be had for the asking, as they are issued from the press. By this means a very complete library would gradually be built up, and would become of great value hereafter.

In my article in the "JOURNAL" for the 21st inst., I did not refer to Mr. Brackenbury's list of gas literature, first published in 1905, because I do not think it contains any works—certainly no early ones—which were not already included in my former list up to the date of its publication in the "Transactions" in 1894. He, however, has done good service by adding many English works published since that date. My former work contained foreign as well as English works and periodicals, published up to the year 1894. Two years later, an excellent list of gas and water literature (English and foreign) was published in Germany by Dr. Steude, in the preface to which he gracefully acknowledges his indebtedness to my former work.

It is obvious that, owing to the very large field covered by my first list, much detailed information had to be omitted. This I have endeavoured to remedy in the list just published, so far as it affects English works prior to 1840. There may still be omissions; hence I would suggest that it would be of great interest, if your readers would furnish information from time to time, through your columns, of the titles, names, and dates of any books or pamphlets not already included in my list. The list will shortly be issued in pamphlet form, with wide margins and blank pages for manuscript notes and additions.

I am obliged to Mr. Brackenbury for his friendly criticisms. I was aware that the first edition of Peckston's "Theory and Practice of Gas-lighting" was included in the 1902 list of works in the library of the Institution of Gas Engineers; but on my recent visit to the library I could not meet with it—only the 1823 edition. Hence I could scarcely say it was to be found in the Institution library.

As regards Matthews' "Compendium of Gas Lighting," this was first published in 1827. Therefore it would have been misleading to refer readers to the Institution library, when a copy of this edition is not to be found there. The Patent Office likewise possesses the 1832 edition, and doubtless several other works mentioned in my list; but unless they are the first editions, the Patent Office could not be referred to any more than the Gas Institution or the British Museum would be under similar circumstances. My list is manifestly a list of the earliest works, and therefore first editions take the first place. Later editions are not so scarce, and may generally be seen at the same libraries as the first editions; for instance, the British Museum has at least four different editions of Clegg's book.

Generally speaking, the British Museum Library contains far and away the best collection—not only of first, but of all other editions. The Patent Office Library ranks next.

71, King William Street, E.C., May 30, 1907. F. S. CRIPPS.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: King's Norton and Northfield Urban District Council Bill, Leeds Corporation Bill, Penrith Urban District Council Bill.
Bills read a second time: Gas and Water Orders Confirmation Bills (Nos. 1 and 2).
Bill reported, with amendments: Wisbech Water Bill.
Bills read the third time and passed: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill, Coventry Corporation Water Bill, Heywood and Middleton Water Board Bill, Maidstone Gas Bill, Pontypridd Urban District Council Bill.

Petitions have been presented against the Hull Corporation Bill, by the East Hull Gas Company and the North-Eastern Railway Company.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read the first time and referred to the Examiners: Ashton-under-Lyne, Stalybridge, and Dukinfield (District) Water-Works Bill. Coventry Corporation Bill, Heywood and Middleton Water Board Bill, Pontypridd Urban District Council Bill.
Lords Bills read a second time and committed: Great Yarmouth Water-Works and Lowestoft Water and Gas Bill, St. Neot's Urban District Council Bill.
Bills read the third time and passed: King's Norton and Northfield Urban District Council Bill, Newquay and District Water Bill [Lords], Penrith Urban District Council Bill.

A petition has been presented against the Local Government Provisional Orders (No. 11) Bill by the Burgess Hill Water Company, in respect of the Mid-Sussex Joint Water Order.

UNOPPOSED BILLS.

The Chorley Order.

The Unopposed Bills Committee of the House of Commons, presided over by Mr. EMMOTT, had before them last Thursday two Local Government Provisional Order Bills, one of which contained an Order applied for by the Chorley Corporation, who asked for borrowing powers for the purposes of their gas undertaking. These had been granted by the Board, subject to their sanction with regard to the period for repayment; and authority was given to use, for the manufacture and storage of gas and residual products, certain lands described in the schedule to the Order. The provisions in regard to borrowing set forth that, in addition to the moneys authorized to be borrowed by the Local Act, the Corporation might, with the sanction of the Local Government Board, borrow upon the security of the revenue of their gas undertaking and of the general improvement fund and rate, such sums not exceeding in the whole £25,000 as might be required for the purposes of the undertaking. The moneys so borrowed were to be repaid within such period, not exceeding sixty years from the date of borrowing, as the Corporation, with the sanction of the Board in each case, might determine; and the period so determined and sanctioned was to be the "prescribed period" for the purposes of the Local Loans Act, 1875, and of the provisions of the Chorley Order, 1897, as applied by the Order under consideration.

Municipal Gas Supply in Sicily.

The British Consul at Palermo (Mr. Sidney Churchill), in his annual report, which has just been issued by the Foreign Office, says that during the year 1906 the policy of municipal trading made some progress, as profits from industrial undertakings seemed to be a possible means of extricating the city from its financial difficulties. The people complained of the high price of gas and its poor quality; and the outlying suburbs were unable to obtain a supply. With the prospect of getting cheaper and better gas, the people voted for the purchase of the gas-works by the Municipality. The City Council counted upon the new administration to assist their funds with a fresh source of revenue. It very soon appeared, however, that the Municipality could not hope to secure any immediate financial advantage from the gas undertaking; and the people were exceedingly dissatisfied with the quality of the gas supplied under the new arrangement. Many of the consumers found their accounts doubled; while the lighting and heating qualities of the gas had decreased enormously.

Malta and Mediterranean Gas Company, Limited.—At the ordinary general meeting of this Company on the 18th inst., the Directors will report a satisfactory increase in the gas-rental, and also in the revenue from coke and fittings and meters, in the year ending the 31st of March last. The balance of the general revenue account is £6134; and the Directors recommend the payment of the usual dividends on the first and second preference capital, and one of 3 per cent., free of income-tax, on the ordinary capital—making with the interim dividend paid in December last 5 per cent. for the year, and leaving a balance of £2044 to be carried forward.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, May 30.

(*Before Justices* DARLING *and* A. T. LAWRENCE.)

Reigate Rural District Council v. Sutton District Water Company.

This was an appeal by the plaintiffs from a decision of Judge Scully at the Redhill County Court. The action was brought to recover £238; being the extraordinary expense incurred in repairing roads said to have been damaged by the defendants in consequence of their orders. They had entered into a contract with one Ewart (who was made a third party to the action) for the construction of a reservoir; and during the progress of the work large quantities of materials were carried over the roads by means of traction-engines. At the conclusion of the plaintiffs' evidence, the Judge held that there was no case, as it did not appear that the damage done was in consequence of any orders given by the defendants, who had no control over the haulage; and it did not appear that the method adopted was either the necessary or the usual one of doing the work, or that others were feasible which would not have caused damage. The plaintiffs urged that the Judge had misdirected himself in holding that the onus lay on them to prove that the method adopted was a necessary and usual one for the carriage of building plant and materials.

Mr. HORACE AVORY, K.C., and Mr. F. O. ROBINSON appeared for the appellants; Mr. DANCKWERTS, K.C., and Mr. W. W. MACKENZIE represented the respondents.

Justice DARLING said the County Court Judge had come to the conclusion that the damage done to the road was not in consequence of the orders given by the defendants. "In consequence" meant the natural consequence of the orders given, not the inevitable or necessary consequence; and the question was, Was there evidence upon which the Judge could say that haulage by traction-engines was not the natural consequence of the orders given by the defendants? He had come to the conclusion that there was no evidence upon which the learned Judge could come to the conclusion that haulage by means of traction-engines was not the usual method of doing the work; and after the evidence adduced for the plaintiffs that the orders had been given, there was clearly a case for the defendants to answer.

Justice LAWRENCE said it was admitted that there had been extraordinary traffic; and the question was whether the Water Company were liable for the damage done as being "in consequence" of their orders. It was proved *primâ facie* that the damage was the result of their orders, and the onus was thrown upon them to show that some method was in fact adopted which was not the natural one contemplated when the orders were given. The appeal would be allowed, and the case must go for a new trial—the costs of the first trial to abide the result of the second.

Mr. DANCKWERTS asked for leave to appeal; but their Lordships declined to grant it.

THE POLLUTION OF AN EDINBURGH BREWERY WELL.

Decree against the Gas Commissioners.

In the Second Division of the Court of Session at Edinburgh on Tuesday last, the hearing of Counsel was begun in the action by Messrs. James Muir and Son, Limited, of Calton Hill Brewery, Edinburgh, against the Edinburgh and Leith Gas Commissioners, in which decree was asked for £10,000 as compensation for the pollution of the Stable Well in the pursuers' brewery by tarry matter, which was said to have escaped from the gas-works in Edinburgh, now disused, which belong to the Commissioners. In June, 1905, Lord Ardwall, in the Outer House, after proof, found the Commissioners liable in £3730; the pollution, in his opinion, having proceeded from what is known as the High Well in the gas-works. The case which had been made by the pursuers was that the pollution came from a tar-tank which had been dismantled; and when the case was taken by the Commissioners by reclaiming note to the Second Division, their Lordships there, on March 7, 1906, allowed the pursuers to amend their record by striking out the specific averment regarding the tar-tank, and substituting a general averment that the pollution "consisted of tarry bye-products of the defenders' manufacture of gas, chiefly water gas, and percolated from the defenders' works to the pursuers' well, through the intervening strata, which dip in the direction of the well." The case having been thus changed to new ground, the Commissioners asked, and obtained, a new order for proof; and they proceeded to excavate mines in their works with the view of discovering if the pollution did or did not proceed from their works. Recently they presented a note to the Court, stating that, as the result of their investigations, they did not propose to proceed with the proof, and asking that the case be put out for discussion upon the new situation that had emerged. This was done.

The pursuers were represented by Mr. CONSTABLE and Mr. HORNE (instructed by Messrs. Finlay and Wilson, S.S.C.); the DEAN OF FACULTY (Mr. Campbell, K.C.), and Mr. J. DUNCAN MILLAR (instructed by their Clerk, Mr. J. M'G. Jack, S.S.C.), appeared for the Gas Commissioners.

[Since the case was disposed of by Lord Ardwall in the Outer House, his Lordship has become one of the Judges of Appeal sitting in the Second Division, and he was thus one of the Judges who reviewed his own decision.]

Mr. MILLAR said that, the defenders having admitted liability, the only matters remaining to be considered were the questions of damages and expenses. Upon the question of damages, on behalf of the Commissioners he had to state that they were anxious to pay what would be reasonable for the pollution which they now found undoubtedly came from their works. They did not propose to attack the Lord Ordinary's award of damages, except in so far as they believed the award to be excessive and exorbitant. It was only upon the footing that the Lord Ordinary, in arriving at the figure which he had fixed, had exceeded in his calculations, and in the basis upon which he founded his figures, what was reasonable, that they were there.

Lord ARDWALL remarked that it was not to be forgotten that there were two ways of assessing the damages, and that the defenders submitted one which brought out a larger sum than had been awarded. One mode was by sinking a well somewhere in the neighbourhood of Edinburgh, about 2 miles from the present brewery, and bringing the water in pipes to the brewery. The estimate for this work was nearly £8000. The other mode was that the pursuers should go on carrying on their business with their Brewery Well, which had not, as yet, been touched, with the aid of town water, which required to be treated in certain ways, in order to fit it for brewing. It was upon this footing that the Lord Ordinary's judgment proceeded; and it came to less than the defenders' estimate (£4238) for bringing in an entirely fresh water supply.

Mr. MILLAR proceeded to say that their attack was principally upon the last item, which his Lordship had in view in making up the £3730. This was a lump sum of £1000, "to cover the inconvenience they have already been put to, and the risk of the taste of the tar not being out of the water at the end of ten years." While the defenders did not adopt the basis upon which the Lord Ordinary had arrived at the results he had, they did not propose to criticize the first items. They did not propose to criticize the £900 for town water for ten years, nor the £460 for hardening it, although, as to the latter, they said that only one-fourth would require to be hardened, as they would get from the Brewery Well the other three-fourths of the water needed for actual brewing. As to the £1040 allowed for pumping the Stable Well for ten years, the Commissioners had no objection to this figure being taken, upon the footing that the money should be applied for the purpose. This matter was of some importance, because it arose upon the evidence that the only object for which the pursuers asked this sum was the pumping of the Stable Well, in order to prevent the pollution getting into the Brewery Well, which was situated at a little distance beyond. The defenders said that the additional £1000 should not be allowed. He had already spoken to the quantity of water which would require to be hardened. Then, with regard to the statement that "mistakes might be made in mixing the chemicals with the water," surely this was a matter which the defenders were not to suffer for. If the defenders' own theory were taken, and if every possible allowance were made for securing an ample water supply, their Lordships would find that the sum arrived at would come out very much less than the sum awarded. If either the one or the other of the alternative schemes which were suggested and proved by the defenders' own evidence—viz., the sinking of a new well or the cementing of the Stable Well and pumping it—were adopted, neither would bring them within £1000 of the sum awarded.

Lord ARDWALL recalled that, according to the estimate of the defenders, to bring in new water would cost £4238.

Mr. MILLAR replied that that was for bringing water from a distance; but the defenders put forward a much simpler scheme, which was to sink a well about 125 feet to the east of the Stable Well.

At this point the Court rose for the day.

Mr. MILLAR, on the resumption on Wednesday morning, proceeded to argue that if a new well were sunk as the defenders proposed, there was every reason to anticipate that an abundant supply of clear water would be obtained. The polluting material entered the Stable Well at a point 183 feet down; whereas the new well would be 20 feet or more above the polluted strata.

Lord ARDWALL surmised that this view proceeded upon the footing that the polluted water ran down the strata; whereas they knew very well no man could say what was the course of water underground.

Mr. MILLAR, with regard to the question of expenses, contended that the defenders had succeeded in meeting absolutely the specific case which was made against them upon the original record, and that to this extent the defenders should be allowed their expenses, as against the pursuers. The original record having been framed as it was, the defenders were only called upon to answer the specific case If they had been called upon to answer the wider charge, and to meet the question of general liability, the Commissioners would have required to have made the investigations they had since carried out. They were, therefore, now entitled to be put into the same position as if they had been called upon to answer the wider charge at the outset; and therefore he submitted that, with regard to the expenses of the pursuers in proving liability, the defenders should not be held liable. As to the expenses incurred by the defenders in making the investigations they had, he asked the Court to adopt the principle that, where an amendment was put upon a record, the parties who had to meet the altered record ought to be put exactly in the same position as if they had had to face the case put on the record in the first instance; and that they should not suffer any loss.

The LORD JUSTICE-CLERK, after consultation with his colleagues, intimated that they did not require to hear Counsel for the respondents, except upon the question of expenses.

Mr. HORNE submitted that the judgment of the Lord Ordinary was right upon this question, and that the pursuers were fully entitled to their expenses. As a matter of fact, the putting on of the amendment involved the defenders in no hardship or expense, and therefore the pursuers should not be mulcted in expenses. The specific allegation which was made regarding the source of the pollution was the occasion of only an infinitesimal portion of the expenses; and, further, the defenders did not, at the proof, confine themselves to meeting the specific case, but sought to disprove that the pollution came from their works at all. Their attitude from the beginning was that the pollution did not come from their works; so they could not now say that they had not notice of the general case as well as of the specific case. As to the expenses incurred in the course of the defenders' investigations, he pointed out that the pursuers required to employ expert witnesses to watch these proceedings; and he submitted that, the defenders having been found to be in the wrong, the pursuers should be allowed the expenses they had incurred in watching and experimenting chemically upon the material found.

The DEAN OF FACULTY, in reply, submitted that, in view of the

radical character of the amendment and their Lordships having differed entirely from the view which the Lord Ordinary took of the record, the effect of the amendment ought not to be minimized, and the defenders ought to get their expenses. A large portion of the evidence was irrelevant to the true issue.

Mr. CONSTABLE contended that, in the face of the proceedings at the proof, it did not rest in the mouth of the defenders to say that, supposing the record had been framed at the beginning as it was now, they would have admitted their liabitity, and so have allowed the engineering and the chemical evidence to be dispensed with. The pursuers brought an action on account of very serious damage which had been caused to their industry. It was a matter of exceedingly great difficulty to trace exactly the source from which the injury had come. It had now been traced to the defenders' works after a great deal of inquiry, after considerable delay, and at enormous expense; and the suggestion of the defenders was that they should be found entitled to the expense of the pursuers having traced home to them the origin of that very serious injury to their premises. If any modification were necessary because of the amendment of the record, the Auditor would do this without instructions from the Court.

The LORD JUSTICE-CLERK, in giving the decision of the Court, said: We have considered the question of expenses. We shall not alter the interlocutor of the Lord Ordinary as regards the amount of damages. We award the pursuers their expenses, subject to a modification of one-fifth of the taxed amount.

DUBLIN POLICE COURT.—Saturday, June 1.

(*Before Mr.* SWIFTE, K.C., *Divisional Magistrate.*)

The Quality of Dublin Gas.

To-day his Worship resumed the hearing of the case in which the Alliance and Dublin Consumers' Gas Company are answering three summonses for having supplied gas of deficient illuminating power (see *ante*, pp. 397, 468, 597).

Mr. IGNATIUS O'BRIEN, K.C., and Mr. PHILIP WHITE (instructed by Mr. Ignatius J. Rice) appeared for the Corporation; Mr. S. RONAN, K.C., and Mr. JOHN GORDON, K.C., M.P. (instructed by Messrs. D. & T. Fitzgerald), represented the Company.

Mr. WHITE, for the Corporation, said that, before entering upon the evidence, there were one or two matters which he wished to clear up, and dispel some erroneous ideas which seemed to exist. It had been suggested by Mr. Gordon that the Corporation Bill of 1896 was thrown out by the House of Lords Committee on the ground that the Corporation had made no case—in other words, that the Bill had failed on its own merits. As a matter of fact, the Bill had been rejected by the Committee on the ground that the award of 1889 having been agreed to by both sides should be adhered to, and that the Corporation had no right to come in and seek to displace it.

Mr. GORDON: The Company never sought to displace the Bill. It was thrown out on Mr. Cotton's own evidence.

Mr. WHITE, continuing, said the net result, however, was that the parties were bound by the award, and had no right to come in and ask for a new arrangement which would have the effect of breaking the contract. This was the case the Gas Company made, and it was the case they succeeded on. Mr. Cotton had been assailed in his position because he had adopted certain methods in reference to testing gas. His evidence before the House of Lords Committee had been utilized by Counsel for the Company with the object of showing that it was on that, and that alone, that they acted in deciding to throw out the Bill. Certain matters which had occurred between Mr. Cotton and Corporation Committees had been referred to; and when Mr. Cotton, in cross examination by Mr. Gordon, was proceeding to read an explanation which he had given before the House of Lords, as showing the relations which obtained between himself and the Corporation authorities, he was stopped by Counsel. Counsel went on to explain that in the Corporation there were two Committees—a Paving and Lighting Committee and a Gas Committee. The first-named, although its primary duty was to look after the street paving, had taken upon itself to interfere with the gas lighting of the city. The other Committee (the Gas Committee) had exercised its functions also as the Council wished it, and had completely exonerated Mr. Cotton from the aspersions which the Paving and Lighting Committee had cast upon him in reference to the testing of the gas. A peculiar aspect of the case was that there were members of the City Council more favourably disposed towards the Gas Company than they were towards the Corporation. In proof of this statement, he mentioned that on the last day the case was before the Court, Mr. W. F. Cotton, who was an alderman of the City Council, had taken his seat on the side of the Gas Company, and gave his assistance in the direction of the case on their behalf. In the same way, the Sub-Committee of the Paving and Lighting Committee, who had sought to embroil Mr. T. J. Cotton, the Gas Examiner, were more concerned as shareholders of the Gas Company than they were about the interests of the citizens of Dublin. The Gas Committee was the only one to which the Gas Examiner yielded obedience; and that Committee in their reports had exonerated him from the blame which the minor Committee had sought to throw on him. Counsel went on to deal with the different statutes under which the prosecution was brought, and said the main point which he wished to emphasize was that under them, and particularly under the Act of 1871, Mr. Cotton was the sole and only judge in the matter. The Gas-Works Clauses Act of 1871, in section 28, specified the testing-place, and the apparatus to be used. It also directed that the testing-places were to be provided by the Gas Company, and that they were to keep the apparatus in good repair and working order. Then section 29 provided for the appointment of "a competent and impartial person" to be the gas examiner for testing the gas at the testing-station. Where there was no such gas examiner, or where the testing of the gas was imperfectly attended to by the local authority, section 30 of the Act provided that two justices, on the application of consumers of the gas supplied by the undertakers, and not less than five in number, might in writing appoint some competent and impartial person to be gas examiner, and such duly appointed person might, at any time within the aforesaid hours, on producing such order, enter on the premises of the undertakers and test the illuminating power and purity of the gas supplied by them. It was furthermore provided that if the undertakers thought fit they might, on each occasion of the testing of the gas, be represented by some officer, who should not interfere in the testing. And by section 34 it was directed that the undertakers should give to the gas examiner and his assistants proper access to the testing-station, and afford due facilities for the discharge of their duties, and, in case of default, they should be deemed liable to a penalty not exceeding £5 to the local authority or to the persons making the application.

Mr. RONAN: Was the Board of Trade to have nothing to say to this matter?

Mr. WHITE stated that the Board of Trade had a special section to itself. What he wanted to impress on the Court was that the Gas Examiner had a well-defined and specific power to test, and that the Local Authority and their agents had the power of access and nothing more. The Gas Examiner, in support of his tests, might produce any amount of expert evidence; but the Local Authority, having nothing but the right of access, had no power to introduce any expert testimony. While the Gas Company had the right to test by as many officers as they liked, and to bring in as many experts as they chose, the Corporation had no power to introduce any person to make any examination or test of the gas except the Gas Examiner. That would be the meaning of the reading of the section, unless it were meant, as he contended it was, that the Corporation Examiner, being selected as "a competent and impartial person," was to be the sole judge and authority as to the quality of the gas. No other interpretation, Counsel argued, could be put on the statute. It must either be contended that the testing of the Official Gas Examiner was to be regarded as final, or else have the anomalous position that there could be an accumulation of evidence to any possible extent on one side, and, on the other, only the evidence of the Gas Examiner. It was for his Worship to decide the point; and he would also have to decide, as incidental to it, what power the Corporation had to send in any other person but Mr. Cotton, their Official Gas Examiner. Counsel next proceeded to deal with the question of costs in regard to the summons for Jan. 29, when it was admitted that the gas was below the standard. In opposition to Mr. Ronan's view, he argued that it was not until the summons had been actually brought, and the case for the Corporation had closed, that it was mentioned that the defect in the gas was due to accidental circumstances arising out of the explosion which had occurred several days previously. He submitted that this was not fair and candid treatment on the part of the Company; and for this reason Mr. Ronan's contention as to costs was absolutely without ground to rest upon. Counsel next opposed the proposition that the proceedings were in the nature of a criminal prosecution—holding that they were purely and simply in the nature of proceedings for forfeiture of moneys by the Company owing to their failure to fulfil the conditions of their contract. As to the evidence brought forward for the defence, that which was mainly relied on was given by Professor Lewes. His evidence in effect was that Mr. Cotton's tests were not to be relied on, because he had not made certain corrections as the result of barometric and thermometric observations. These corrections depended on certain tables; but the tables had not even been mentioned or referred to in any way either in the Acts of Parliament dealing with the Dublin gas supply, or in the award which specified the instruments which were to be used in connection with the testing. The contention of the Corporation was that, under the operation of the award, the testing of the gas was carried out by means of apparatus which was entirely out of date; and although this was the case, they were supposed to employ methods of correction, which could only be approved of in connection with appliances which were thoroughly up-to-date, such as they had in London and in the private testing-station of the Corporation. Counsel next adverted to the reports of the late Professor Tichborne, which he maintained could not be legally admitted. The evidence of Mr. Brent, of the Gas Company, could not be relied on; and the relations which the litigation in the Recorder's Court and the Superior Courts showed to exist between him and Mr. Cotton justified, in his (Counsel's) opinion, the statement that his evidence was unworthy of being considered. On the whole aspect of the case, Counsel held that the application of the statutes made it mandatory on his Worship to enter a conviction on each particular summons.

At the close of Counsel's speech,

Mr. SWIFTE intimated that he would reserve judgment. In the meantime, he purposed visiting the testing-station, and inspecting the instruments used in the testing of the gas.

The Dispute about a Monazite Sand Contract.

Last Tuesday the action of the *United Gas Improvement Company v. Gordon* came before Lords Justices Vaughan Williams and Fletcher Moulton, upon an application by the defendant that the plaintiffs might be ordered to give security for the costs of the appeal. The action was tried before Mr. Justice Bigham, and, after a hearing extending over many days, resulted in favour of the defendant (as recorded in the "JOURNAL" for Jan. 22), whose taxed costs amounted to £3223. The plaintiffs, who are a Company carrying on business in Philadelphia, had given notice of appeal, and had offered to give security to the amount of £250; but this the defendant contended was a totally inadequate amount having regard to the nature of the case. Their Lordships thought the sum tendered was sufficient, and ordered the security to be given within a month; the costs of the present application to be costs in the appeal.

For stealing a gas-meter, valued at £5, the property of the Manchester Corporation, from an unoccupied shop in Medlock Street, Hulme, on May 30, Patrick Murphy, William Burgess, and Patrick Walsh were next day sentenced to four months' imprisonment, with hard labour.

MISCELLANEOUS NEWS.

NOTTINGHAM GAS INQUIRY.

Special Committee's Report—Engineering Methods Vindicated.

[From Our Local Correspondent.]

By those who have followed the progress of events in relation to the management of the Nottingham Corporation gas undertaking, the fact that the Special Committee recently appointed to deal with the matter have arrived at conclusions which are in the nature of a complete vindication of the methods pursued by the responsible Engineer (Mr. J. H. Brown), will be received with no surprise. The result, however, has not been arrived at without the expenditure of much valuable public time, and incidentally the introduction, in certain quarters, of a good deal of unnecessary feeling in regard to points which called simply for decision upon the basis of technical knowledge. It was inevitable, after the turmoil raised upon the question at the last municipal elections in Nottingham, that the matter could not be allowed to rest with the presentation of the report of the Special Committee presided over by Alderman Sir John Turney, which, while finding that nothing had been established against Mr. Brown, recommended a division of responsibility by the rearrangement of duties and the appointment of an extra official. So much bitterness had unfortunately been introduced into the controversy, and there had been so much made of an incident in regard to the treatment of a trading company in which certain members of the Gas Committee were interested—a matter of infinitesimal importance in contrast with the general question which was at issue as to the efficient management or otherwise of the works—that it was impossible to resist the demand for an inquiry with open doors. The Committee, presided over by the Mayor (Alderman J. A. H. Green), and composed also of Councillors S. Cook, E. L. Manning, E. N. Elborne, and T. J. Dabell, held ten public sittings between March 7 and April 25; a great mass of evidence being taken, as the reports have shown, mainly from Mr. Brown, upon points of technical detail. The key-note of the report, which is a unanimous one, is the conclusion arrived at by the Committee that the investigation has disclosed no reason for doubting the ability of the Engineer to manage the undertaking. As to the incident connected with the Railway and General Engineering Company, about which such a storm in a teacup had been raised, the Committee indicate their view by the significant expression that nothing practically would have been heard of it if, instead of the late Chairman of the Gas Committee (Mr. E. Harlow) taking the personal responsibility upon himself, he had brought the matter under the notice of his colleagues.

The Text of the Committee's Report.

The Gas Public Inquiry Committee beg to report that, in accordance with the instructions of the Council, the Committee have held a public inquiry into the working of the gas undertaking during the past five years. They caused advertisements to be inserted in the local newspapers announcing the dates of their sittings and their readiness to receive evidence. The response was very small indeed—much smaller than the Committee anticipated, in view of the widespread interest shown by the public at the time of the previous inquiry.

They have held ten public sittings; the principal subjects dealt with being as follows: General history of the undertaking from 1902 to 1907, including the appointment of the present Engineer; proceedings of the Committee as to complaints and as to candle power; method of dealing with contracts; purchase of coal; use of blue water gas and carburetted water gas; condition of plant; naphthalene difficulty; distribution; minutes of Committee; chemical plant; candle power and quality of gas; irregularities at Eastcroft; expenditure (capital and revenue) on works, &c.; method of dealing with complaints; Sunday work; reduced candle power; Railway and General Engineering Company's account; purchase of meters; Mr. Harlow's statement to the Council; the Engineer's outside work; carbonizing results; type of coal used; comparison with other gas undertakings; capital and revenue expenditure; stocktaking; coal stocks; Eastcroft chimney removal; reserve and other funds.

Your Committee had no instructions to report; but in laying the evidence before the Council, they venture to submit certain observations which the Council and the Gas Committee may perhaps think worthy of consideration. Your Committee do not feel in a position to ask that their views may be adopted, as their inquiries were subject to great limitations by reason of the absence of expert witnesses other than the Engineer of the undertaking.

CONSUMERS' COMPLAINTS.

1.—Your Committee devoted considerable time to the investigation of the causes of complaint as to the illuminating power of the gas during the past few years. On the evidence before them, your Committee are of opinion that if the Gas Committee's original policy (adopted on the advice of the Engineer) of arranging for the care and inspection of consumers' burners concurrently with the reduction of candle power had been carried into effect, it would have very greatly reduced the number of complaints made in 1904, and the first eight months of 1905.

The percentage of consumers' complaints (excluding public lamps and naphthalene) in the year ending March 31, 1903, was 23·57. During that year the old candle power was maintained until the beginning of March, when it was ordered to be reduced to 16 candles. In the following year (ending March, 1904), after the reduction of the candle power, the percentage of complaints fell to 22·63. Then in the year ending March, 1905, a further reduction of candle power took place, and the complaints increased to 24·70; while in the following year, during which the plant at the Eastcroft was manipulated for three or four months, they increased to 25·63—this being accounted for by the large number of complaints in those three or four months. It would appear, therefore, that the reduction below 16 candles found out the inefficient burners and fittings. In many cases where the department advised the substitution of other burners, or alterations in fittings, the cause of complaints was remedied. The tendency in other places is towards reduced candle power; and if consumers were properly advised as to the burners most efficient for lower candle power gas, they would in all probability not complain of the illuminating effect. The special needs of lace factories require careful consideration before any great reduction is made.

Between 1903, and December, 1905, blue water gas was being made at Basford. The percentage of this gas recorded as being passed into the mains was, however, small; and there is no evidence to show that complaints were due to the use of water gas. The maximum on any one day as recorded was 8 per cent. of the make at Basford; while for the year ending March, 1906, the percentage of blue water gas recorded was 3·48 of the make at Basford, or 2·33 of the total make at the three gas-works.

SOME OF THE CAUSES OF THE TROUBLE.

Another cause of trouble was the difficulty of controlling the pressure in the course of distribution, owing in part to the difference of level in different parts of the supply area, varying from 80 to 460 feet above sea level. The distribution plant is now in an efficient condition; the district having been divided into different sections corresponding with the different levels. This was not completed till the end of 1906. It was an added misfortune that naphthalene, which for three years had caused little trouble, gave rise to very numerous complaints in 1904 and the following years.

The Eastcroft wrong-doing brought matters to a head; and the state of things at these works was unsatisfactory in the extreme. It was not disputed that for three or four months in the autumn of 1905 serious malpractices were committed at the Eastcroft works. The plant was manipulated in such a manner that the gas was vitiated, and the figures recording the candle power were falsely recorded. According to the statements made by the workmen, very unsatisfactory conditions had existed for some 18 months, and this may have added to the volume of the complaints. There appears to have been an averaging of candle power records that makes the statistics of little worth. Your Committee were assured that the figures are now kept accurately, and that the bar photometer is read at frequent intervals during the whole 24 hours, instead of only twice during the daytime.

THE ENGINEER'S DIFFICULTIES.

While giving the Engineer every credit for his industry and his desire to discover the cause of the complaints which were rife, your Committee regard it as very unfortunate that the serious state of things at Eastcroft was not discovered sooner. Surprise visits to these works during the night might have led to an earlier discovery. The fact that the tests with the bar photometer were not taken after six or seven o'clock in the evening made it the more desirable that late visits should be made. The Engineer appears to have placed too great reliance on a subordinate in whom he had confidence. It is probable also that the immense volume of the duties which devolve on the Engineer (to which reference is made hereafter), the impossibility of ascertaining from which works the gas which was tested came, and also the system of receiving complaints, handicapped him in his efforts.

NOTTINGHAM COMPARED WITH OTHER PLACES.

2.—In the years between 1892 and 1902, in which latter year the present Engineer was appointed, there was a very serious falling off in the results of the gas undertaking. Until 1893, Nottingham stood as high as any undertaking in the country in efficiency and financial results. In the years immediately following there was an astonishing falling off in comparison with the undertakings of other towns, whether managed by corporations or by companies. The circumstances of Sheffield are very exceptional; and no undertaking in the country can compare with that in financial results. But the striking fact remains that fifteen years ago Nottingham was on an equality with Sheffield in the net cost of production, after allowing for the proceeds of the realization of residuals. Your Engineer's theory is that the Sheffield undertaking has equipped itself specially for the purpose of using the valuable supply of gas-producing and coke-producing coal which exists at its doors.

But, Sheffield altogether apart, the relative position of our undertaking with several other concerns tells a tale of deplorable falling away during that period, It is not possible, at this distance of time, to assign all the reasons; but your Committee are of opinion that the permission tacitly given to the then Engineer to devote attention to private work contributed to the unfortunate position into which Nottingham fell. It cannot be said that during the last five years Nottingham has made up the leeway. It is true that in certain cases our financial results have improved relatively to other towns. But relative reduction of candle power has somewhat contributed to this; and it is clear that, though some improvement has been made, much remains to be done before we can return to the relative position occupied in 1892. The comparisons made with other undertakings are based upon "Field's Analysis" for 1905—the last published edition. Our figures for 1906, however, would not have been of great value, on account of the admitted manipulation of plant and the falsification of candle-power records which took place during the year ending March 31, 1906.

GAS COMMITTEE CHAIRMAN AND ENGINEER.

3.—It appears to have been a tradition in the Gas Department that a large part of the business should be undertaken by the Chairman in conjunction with the Engineer. From every point of view, it is desirable that the responsibility for the work should be fully borne by the whole of the Committee; and your Committee are glad to know that this course is now being followed.

RECEPTION OF CONSUMERS' COMPLAINTS.

4.—Your Committee are of opinion that it would be wise, as recommended by the Engineer, to alter the present system of receiving complaints. The existing custom is for consumers' complaints to be made to a clerk in the Accountant's Department, who has no practical knowledge. It seems desirable that they should be made to an official possessed of such knowledge, and therefore with greater ability to make full inquiry as to the nature of the complaints.

USE OF BLUE AND CARBURETTED WATER GAS.

5.—Your Committee are informed that blue water gas is now being largely used in the Berlin Gas-Works, and that certain English undertakings are also utilizing it. To make this species of gas would undoubtedly be a great economy, and render possible a further reduction in price. But your Committee are of opinion that very full inquiry and investigation should be made as to the experience of the places where it is used; and if the results are found to be satisfactory, the existing plant should again be put into operation.

With reference to carburetted water gas, however, your Committee believe that this is sufficiently in vogue to justify its use in Nottingham. Leicester appears to have found it successful; and inquiry at that town would not involve great expenditure either of time or money. This species of gas, while not economical as a constant substitute for coal gas, may be economically used in certain cases of emergency, and in certain conditions of the market for coke.

LETTING OUT STOVES AND METERS.

6.—The desirability of continuing the present system of letting out stoves on hire should be carefully considered. The figures show that there is a direct loss on this side of the undertaking, amounting to about ¾d. per 1000 cubic feet. It is probable that, owing to depreciation, this loss is greater. Your Committee were informed, however, that many of the customers who hire stoves are slot-meter consumers, and therefore make up the loss indirectly by the extra 10d. per 1000 cubic feet which they pay for gas. They are also told that the day-load in Nottingham is small, and ought to be encouraged. It is to be observed that the Sheffield Company apparently do not undertake this line of business. This is, however, probably accounted for by the fact that the day-load is large, owing to the great consumption of gas in that town for purposes of manufacture.

The policy of letting out stoves was, no doubt, a wise one when the usefulness of gas for cooking and heating purposes had to be brought prominently under the notice of the public, and has resulted in considerable increase in the consumption of gas. At present, however, its value is well known; and it is doubtful whether there would be any appreciable falling off in the use of stoves if customers were not able to hire them from the Corporation, but had to make provision for themselves.

THE ENGINEER AND HIS WORK.

7.—Your Committee are of opinion that complaint cannot fairly be made against the Engineer for having diverted time and attention from the Corporation work by advising the Holyhead Gas Committee, or in the preparation of the paper read by him to the Institution of Gas Engineers. The Gas Committee sanctioned the Holyhead matter; and, moreover, the Engineer states that the service he rendered was in his holiday time, and not in the time of the Corporation.

His paper was the outcome of experiments which were made at Basford by chemists in the employ of the Gas Committee. The Committee appear to have sanctioned these experiments, though they, not being technical experts, probably were not aware of their detail and extent. The paper largely consisted of statistics of the experiments. The Engineer states that the experiments were made in the interests of the gas undertaking; and your Committee see no reason to doubt this.

THE PLACING OF CONTRACTS AND ORDERS.

8.—There is nothing to suggest that undue or improper preference has been given to any company or firm in connection with the contracts and orders of the Gas Committee. The evidence as to the contracts of the Gas Committee shows them to have been entirely proper and straightforward. Your Committee are of opinion that in future, in all cases where possible, tenders for plant or large quantities of material should be advertised for. Your Committee venture to record their opinion that a shareholder in a company with which a committee has dealings should not be present during the discussion of matters affecting the business relations between the committee and the company. This suggestion is made with a view to preventing misapprehension and criticism, and not with reference to anything which has come under their notice.

The system of purchasing coal by contract extending over a period has been restricted in favour of obtaining purchases from time to time. No objection can be taken to this, so long as the control of the Committee is fully maintained. Sir George Livesey's recommendation to limit the number of collieries from which coal is obtained did not at first sight appear to have been followed to any great extent, as the number of such collieries was not largely reduced; but, on looking into the quantities, it is clear that the great bulk is now being purchased from a few collieries.

THE ALLOWANCE ON A GAS ACCOUNT.

9.—Your Committee inquired into the circumstances attending the allowance of £35, made in January, 1906, to the Railway and General Engineering Company, Limited, on their gas account in respect of the claim made by them. There was clearly a misunderstanding between the late Chairman and the Gas Engineer upon this matter, and a considerable difference in their statements as to the circumstances. Your Committee are of opinion that the late Chairman would have been wiser to have referred the matter to the Committee instead of dealing with it personally, and that if this course had been followed no difficulty would have arisen on the subject.

ENGINEER'S DUTIES AND CAPACITY.

10.—Your Committee desire to follow Sir George Livesey in urging a division of the duties now devolving upon the Engineer. Reference to the terms of the Engineer's appointment shows the great volume and variety of the work he is called upon to perform. It is not improbable that the Eastcroft affair would have been discovered earlier if the multifarious duties falling upon the Engineer had been less numerous and exacting.

11.—No charges were made against the Engineer; and the inquiry showed no ground for doubting his capacity to manage the undertaking.

BIRMINGHAM CORPORATION GAS SUPPLY.

A Meeting of the Birmingham City Council was held last Tuesday—under the presidency of the LORD MAYOR (Mr. Sayer)—when the report of the Gas Committee, containing the annual accounts (noticed in the "JOURNAL" for May 21, p. 539), was submitted.

The Salary of the Secretary.

Alderman Sir HALLEWELL ROGERS first moved, in accordance with a recommendation in the report, that the salary of Mr. G. Hampton Barber, the Secretary of the department, should be increased from £1200 to £1400 per annum from the 1st of June next. Some days ago, he met a member of the Council, who asked him whether he thought Mr. Hampton Barber was worth the increase. He need hardly say he would not have brought up the proposal unless not only himself but all the members of the Gas Committee thought it a right and fair recommendation to make. He did not think the Council, composed as it was of so many business men, would be led astray by anonymous writers of letters to the newspapers—evidently men who were only too anxious to express their opinions on matters they did not understand. The Birmingham gas undertaking was the largest of its kind out of London. Big commercial undertakings must of necessity be conducted with a certain amount of privacy; and he could not even disclose to the Council all the reasons which brought the Committee to the unanimous conclusion that it was their duty to the official concerned, and to the city, to bring forward the present recommendation. It was absolutely necessary that they should have the best possible officials; and if they secured the best men, they must adequately remunerate them. Mr. Barber advised the Committee on the general administration of the department. In conjunction with the Chief Engineer, he advised upon the purchases of coal and oil; and where specific coals were decided upon, he personally conducted and completed the negotiations, involving an expenditure of over £300,000 a year. In addition, he had to negotiate the disposal of residual products, of which the sales amounted to over £200,000 per annum. Mr. Barber had discharged all his duties to the satisfaction of the Committee, and had always assisted them in keeping down the capital expenditure, thereby saving the ratepayers' money. During the six years Mr. Barber had been with them, the sales of gas alone had increased by no less than 800 million cubic feet; while the surplus contributed in aid of the rates had averaged £52,000, as against £31,000 in the previous ten years, and the average net price of gas during the last year was the lowest in the history of the undertaking. It had been objected that the former Secretary, Mr. Edwin Smith, when he left was in receipt of only £1250 a year. Older members of the Council would, however, be aware that Mr. Smith was urged many times to allow the Committee to bring forward a proposal for an increase; but he always refused, on the ground that he would rather be underpaid than submit himself to a debate in the Council.

Mr. WALTHALL (after the motion had been seconded) remarked that if the successful management of a department was a reason why the officials should have their salaries increased, then the salaries of the officials of departments which were not successfully managed should be reduced. This, he insisted, was going back to a perfectly sound principle of business. The Council needed to consider that Corporation officials avoided the risks they would have to incur if they remained outside. When a man was appointed by the Council, he came into a haven of security. Mr. Barber was the Manager of the commercial department of the undertaking—nothing more. Mr. Hack was entrusted with the manufacture of gas, and received £1500; and he was supported by a number of assistant engineers who were badly paid in comparison with Mr. Barber. It was no secret that before long there might be some changes in the Gas Department. It was said that one of the chief officials might take his superannuation, and that then there would probably be some rearrangement of the offices. If this were so, then that would be the time for the Committee to bring forward a scheme respecting salaries. At present, he thought Mr. Barber was very well paid; and he should therefore oppose the resolution.

Alderman Sir WILLIAM COOK thought the resolution should be considered from a business point of view. The department was governed by a Committee who had the entire confidence of the Council; and they were unanimous in recommending that Mr. Barber's salary should be increased. No one would deny the right of the Council to criticize the actions of the Committee; but respect should be paid to their recommendations. There was no member of the Committee who was not anxious to keep down the expenditure; but they were also anxious when they had good servants to acknowledge their services by giving them that to which they were entitled, and, in their opinion, Mr. Barber was entitled to the increase proposed. The Committee had brought before the Council one of the most successful balance-sheets ever presented to the Corporation; and much of the credit of this was due to Mr. Barber. To his mind, Mr. Barber was entitled to the increase suggested by the Committee; and he hoped the recommendation would be carried.

Mr. KELLY and Mr. STEPHENSON opposed the proposition—the latter urging that the time was not opportune for raising Mr. Barber's salary.

Alderman EDWARDS, in supporting the motion, pointed out that the term "Secretary" very inadequately represented Mr. Barber's duties. He was the chief executive officer of a great department; and he had to keep a watchful eye on everything directly and indirectly relating to it. He had to be on the alert for the proper time to initiate great and important new departures; and Mr. Barber had initiated matters which had been remarkably successful. When the two original gas undertakings in Birmingham were acquired by the Corporation, they represented together only about half the turnover of the present

undertaking; and yet they were governed by two Boards of Directors, who divided £4000 a year. Practically the whole of their responsibilities devolved upon an honorary Committee; and surely this Committee were justified in securing a head official of the highest ability. Mr. Barber had proved by his six years' service that he was thoroughly experienced in his work.

Mr. FREEMAN opposed the increase, because the time was not opportune for granting an advance. Mr. Barber, he said, did not ask for it; but it was the desire of the Committee that he should receive it. He felt sure if it had been put to Mr. Barber that the matter should be delayed because of the desire on the part of the spending Committees and of the ratepayers to keep down the expenditure, he would have fallen in with the suggestion. He did not agree with Alderman Edwards that Mr. Barber was the chief official of the Gas Department. In his opinion, the chief official was the Engineer, who was in receipt of a larger salary than Mr. Barber had.

Mr. JACKSON believed the Gas Committee had a splendid Secretary in Mr. Barber; but he considered that he was already adequately paid for his services. The burdens of taxation, he contended, did not justify the increase; and from many quarters he had heard the proposal condemned.

Alderman CLAYTON, as Chairman of the Finance Committee, said he should vote for the increase. As a ratepayer, he had the greatest respect for a man who brought in £4000 more to the ratepayers last year, and £7000 more this year than was expected. He thought he should be inclined to put that man at the top of the list of officials. For five years he was a member of the Gas Committee; and he knew the services rendered by Mr. Barber. During that gentleman's term of office, they had not only received large sums in relief of the rates, but there were other amounts written off the gas capital; so that the figures mentioned did not represent all that had been done. They were indebted to Mr. Barber for a great deal of this; and when they considered the commercial value of such a man, he said that he was worth £1400 a year. He was sorry a comparison had been made between Mr. Barber and Mr. Hack. The latter was the Technical Manager of the gas-works; and he did not come in contact with the public in the way Mr. Barber did. Mr. Barber had control of the buying of coal and the selling of coke, &c.; and it was a mistake to compare his office with that of Mr. Hack. They must work together harmoniously, if the results that had been achieved were to be produced.

Mr. BOWATER also was of opinion that the way in which Mr. Barber made the huge purchases of coal showed his great commercial knowledge and ability; and that was sufficient of itself to justify the increase.

On a division, the resolution was carried by 29 votes to 20.

Results of the Past Year's Working.

Alderman Sir HALLEWELL ROGERS then moved that the report of the Gas Committee be approved; and in doing so, said that the main question, and the one of the greatest interest to the Council and the ratepayers, was the financial result of the past year's trading. The Council would notice that there had been expended on capital account £34,108; fully one-half of this (£17,485) being due to the provision of meters—mostly prepayment. The new accounts opened with this class of consumer during the past year were no fewer than 6267, or over 500 per month. On the other side of the account, it would be observed that no new borrowing had been made during the year; but, on the other hand, that annuities, Corporation stock, and mortgages were redeemed out of sinking fund moneys to the value of £31,246—the debt on the undertaking now standing at £2,151,584. In reference to the revenue account, during the year the quantity of gas sold and used in the works was 6732 million cubic feet, or 164¾ millions more than in the previous year—an increase of about 2½ per cent. This, in view of competition from several sources, the Committee regarded as satisfactory. But the larger output of gas had necessitated the use of what was equal to 3303 tons more coal. Wages at works showed an increase of £4500; this being due to more coal and less oil having been used in manufacture. It was also partly due to the increase of wages granted to the workmen last October. The item of repair and maintenance and renewal of plant on works showed an increased expenditure; but this was owing to exceptional charges which occurred at infrequent intervals on so large a plant, and they were glad that they had been able this year to meet this large outlay, and at the same time make a greater contribution in aid of the rates. Amounts for rates and taxes were heavy; and, regarding this expenditure, he felt he should like to join the Ratepayers' Associations both within the city and in the outlying districts within their area of supply. The burden on the undertaking for rates and taxes was considerable, for it had been increased in the past twenty years by nearly £25,000. Turning to the credit side of the account, the Council would see that in the sale of gas they had the full effect of the reduction in price granted to manufacturers for gas used for motive power purposes. They had practically maintained their sales of gas for power. Had it not been, however, for keen competion in certain directions, they would have undoubtedly increased these sales. The result of the trading for the year showed a gross profit of £178,596; and this profit had been obtained when the average price charged for gas had been the lowest in any year since the Corporation acquired the properties of the two Gas Companies in 1875—namely, 2s. 0½d. per 1000 cubic feet. In the last three years they had made a reduction of 1d. per 1000 cubic feet in the average net price of gas, which represented a saving to consumers in the past year of £28,000. It would be interesting to the ratepayers and consumers—especially to those resident outside the city—to know that the gross profit shown in the Gas Committee's accounts was a smaller charge per 1000 cubic feet of gas sold than was required and exacted by ninety-six out of every hundred of the gas undertakings in Great Britain. It would be seen, therefore, that not only consumers within the city, but also those resident in out-districts, were well served by the Corporation; and it should not occasion feelings of envy if, by good management, the Corporation, after paying all charges on capital and providing for sinking funds for the redemption of debt, were enabled to declare so large a surplus as £57,563, which was the largest sum contributed by the department in aid of the rates any year since the gas undertaking was purchased.

Some questions having been asked with regard to alleged dismissals from the works, and whether some relief could not be given to the small gas consumers,

Mr. ARTER reviewed the accounts at length. Comparing the profits and costs of the undertaking with those of other gas enterprises, he urged that there should be a reduction in the price of gas. The price from which the department's excessive profit was made, he contended, fell most harshly and unfairly on manufacturers, shopkeepers, and large consumers; and they were entitled to consideration.

Alderman Sir HALLEWELL ROGERS, in reply, said that they were conducting the work of the department on the lines laid down by Mr. Joseph Chamberlain and his successors; and it had gone on increasing. It was true that the capital of the undertaking was more than it was; but this was due to good management. They had to hold the balance as nearly as possible between the ratepayer and the consumer; and he was surprised that Mr. Arter should have brought this matter forward in a year when they had given the largest sum towards the reduction of the rates, while they had supplied the gas at the lowest average price that had ever been charged. Dealing with the subject of dismissals, he said they had to dismiss in the summer men whom they would keep on in the winter. In April and May of the present year they dismissed 262 men, last year they dismissed 262, the year before 245, the year before that 251, the year before that 337, and the year before that 266. So that they would see the number of dismissals was fairly normal. Nobody was more sorry for the men dismissed than were the Committee; and if they could help them to obtain work in other places, they would be only too glad to do so.

The report was approved.

The Price of Gas.

Subsequent to the Town Council meeting, a representative of the "Birmingham Mail" had an interview with Councillor Arter on the point as to whether the time had not arrived for a review of the price of gas, and whether the existing charge was falling fairly on the large consumers and shopkeepers and on those who obtained their supply on the penny-in-the-slot principle.

Mr. Arter made the following statement in the course of the interview: "It is not as if the making of gas in Birmingham was not a profitable business. It pays the Corporation very well indeed; and it is to be noted that the sinking fund far exceeds the statutory limit. If the complaint I am making were aimed at the Water Department or at the Electric Light Department, it would be different. Take the case of the former. Here am I, paying £9 a year for water, the value of which is a few coppers. But that cannot be helped; and I do not complain. If, however, a huge profit was made on the water, and part of it went to the reduction of the rates, I should complain, seeing how little value I get for my £9. But with gas the case is utterly different. Sixty thousand a year of capital is charged to revenue. A huge profit is being made; and all that is being done to alleviate the position of the man who uses and pays a high price for the gas, is a slight reduction in the rates. Let us take as an illustration of the point the case of a manufacturer who pays £1000 a year for the gas he uses. Of this amount £500 is profit to the Corporation; and in return he receives probably £10 in the shape of a smaller rate. Again, to turn to the smaller consumer, who suffers in a variety of ways. In the first place, he receives no advantage at all from the reduced rate, because in most cases his landlord pays that; and all the while, though probably he does not know it, he is paying indirectly a number of the city's bills which lie outside the scope of the Gas Department altogether—for instance, the courts are lighted at the expense of the Gas Committee, the Art Gallery is similarly privileged, and £4000 is taken from the sinking fund and put to the improvement rate at the expense of the gas consumer—all of which shows that the willing horse will be overburdened until he vigorously protests. Coal is going up in price; but the Gas Department will still make their profit, because all they will have to do will be to regulate the buildings and plant they abandon. Instead of abandoning £50,000 or £60,000, they will probably abandon only £10,000, and adjust their finances with the greatest ease. Last year the surplus profit, as it is called, from the Gas Department, amounting to £55,000, was placed to the relief of the borough rates; but they still continue to charge 1s. 7d. per 1000 cubic feet for power purposes, and 1s. 10d. for lighting and manufacturing. If you take the case of Smethwick and West Bromwich, in the former, for power purposes, the charge is 1s. 6d., and in the latter 1s. 5d. per 1000 cubic feet, which includes all gas for all manufacturing purposes other than power consumption. What is the result? When a Birmingham firm want to build a new place, they go to these less expensive places. It is argued that the outside consumer who takes no risks on the gas undertaking would get the benefit of any reduction in the price of gas without a corresponding responsibility such as the man in Birmingham incurs. The Act, of course, lays it down that we must supply consumers inside and outside the city at the same rate, so that by keeping the price of gas high we punish them, or rather make them contribute a fair amount of the accumulated profit. But it is absurd to take this view, if it means that you have to punish your own gas consumer at the same time. I have come to the conclusion that the only fair way to treat the consumer is to reduce the price of gas, as your profits will allow you, to the minimum. At present, it is obvious in Birmingham that the profits are by no means fairly distributed; and an adjustment of the price is urgently needed. The existing system bristles with unfair features. The consumer of electric light, who at present contributes no profit to the city in that respect, gets the same advantages as a large consumer of gas. In other large cities, the course I suggest is adopted, with the result that the man who directly bears the burdens feels the advantage of a profitable year's gas making. Why should a large consumer contribute hundreds of pounds to the gas undertaking, and receive a few paltry pounds back on reduced rates? He wants to pay a commercial price for his gas. Then if he gets some relief on his rates, well and good. To all concerned the most logical and fair policy is to supply gas on a scale of prices going down according to the quantity taken. Having built up a sound concern, the consumers are now entitled to a substantial reduction of price, amounting to 10 per cent. all round, which would still leave £55,000 profit to go to the reduction of rates generally."

DEVONPORT GAS UNDERTAKING.

Satisfactory Result of the Past Year's Working.

Mr. J. W. Buckley, the Engineer and Manager of the Devonport Gas-Works, presented his report for the year ended March 31 at a meeting of the Gas Committee last Tuesday. The report, which is the most encouraging and satisfactory that the Committee have received since the Corporation took over the undertaking, deals exhaustively with the position of the concern.

With regard to last year's working, the report states that the total quantity of gas made was 342,886,000 cubic feet, of which 83·72 per cent. was coal gas and 16·28 per cent. water gas. The maximum daily percentage of water gas was 27·14, on a day in August last. The total quantity of coal used was 28,073 tons; while of oil 157,207 gallons and of coke and breeze 1693 tons were used. Compared with the previous year, the coal was 7216 tons less; but, on the other hand, the oil and coke and breeze are new items, the manufacture of water gas having been begun during the year. The gas made per ton of coal and cannel carbonized was 10,224 cubic feet (as against 9881 cubic feet the previous year); and the oil used was 2·81 gallons per 1000 cubic feet of gas made. Mr. Buckley says that the production per ton is a record, if the make of 1905 (given as 10,282 feet per ton) is corrected by the coal deficiency discovered early in 1906. Though many gas-works have much greater yields per ton, these results are highly satisfactory considering the antiquated condition of the retort-house, retort-benches, and fittings.

Under the head of distribution, the following table is given of the various heads under which the quantity of gas sold was divided, together with the increase and decrease in the year :—

—	Cubic Feet.	Increase. Cubic Feet.	Decrease. Cubic Feet.
Private consumers	185,021,450	3,285,050	
Government establishments . .	52,458,600		8,210,800
Prepayment meters	72,830,575	8,275,870	
Public lighting	21,323,500	496,500	
Total	331,634,125	12,057,420	8,210,800

It is pointed out that a decreased consumption in the Government establishments has been anticipated for several years. During last year, 1343 prepayment meters and automatic installations were fixed; bringing the total number up to 7551. The average consumption per meter was 9645 cubic feet, and the average revenue £1 11s. 9d. An addition of 94 to cookers fixed has brought the total to 637.

In the public lighting department considerable work has been done. Thirty new lamps have been fixed and 407 converted from flat-flame to incandescent burners, with new lanterns of modern design in nearly every case. At the end of the year, there were 908 public lamps with incandescent and 172 with flat-flame burners, and Mr. Buckley anticipates that this year the conversion will be completed. The cost of conversion has been carried out by the Gas Committee, who spent £203 upon it last year without making any charge to the Lighting Committee.

With reference to residuals, the report shows that the production last year was 18,287 tons of coke and breeze, 263,227 gallons of tar, and 259 tons of sulphate of ammonia. These figures work out to an average of 13 cwt. of coke and breeze, 9·37 gallons of tar, and 20·67 lbs. of sulphate per ton of coal carbonized. The most conspicuous feature is the comparatively high yield of sulphate of ammonia this year. If the yield of 17·56 lbs. in 1906 is eliminated for comparison, the record make of 20·67 lbs. exceeds the previous maximum by 6·81 lbs. per ton of coal and cannel carbonized, which is equivalent to an increased production of about 50 per cent.

The accounts show that the gross profit amounted to £19,331; and after deducting £17,143 for interest and repayment of loans, there is a net profit of £2188. Last year the gross profit was £16,345, the amount required for interest and loan repayment £15,464, and the net profit £881. In explanation of the increase of net profit, Mr. Buckley says the financial working has been affected by three changes, all of which have been carried out without any additional charges on capital account. These are: (1) The non-bagging of the coal on discharge of the vessels, which saves 4¾d. per ton, or £556; (2) reduction of carbonizing wages by 6¼d. per ton, amounting in all to £731; and (3) increased production of sulphate of ammonia 85 tons, realizing a net profit of £690. These three items together make a total of £1977. With regard to the reduction of the wages item, Mr. Buckley says that, though they have stoking machinery which cost £4000, there was as much being paid for wages as if there were no machinery erected. Even now, in spite of the reduction, he finds the works cost for carbonizing is the highest per ton of coal among undertakings using similar machinery.

The alterations carried out during the year include the bringing into use of the new gasholder, the removal of the station-meter to another part of the works, and the inauguration of the carburetted water-gas plant, which has given most satisfactory results. The tar and liquor pumps, which formerly were scattered all over the yard, have been placed in one house; the stoking machinery has been thoroughly overhauled, and several improvements made, with the result that the drawing is now done in half the time formerly occupied; and the photometer has been removed from the technical school building to the works. Mr. Buckley points out that a number of further alterations and improvements are necessary. Although there has been considerable capital expenditure, no money has been spent on the retort-house; and until either a new house is built or considerable alterations are made to the present one, combined with an installation of modern carbonizing plant, no saving can be effected in the cost of coal-gas manufacture. Additions are also required to the exhausting plant, together with new tar-extracting, scrubbing and washing appliances, and governors.

The Chairman of the Gas Committee (Alderman W. Hornbrook), in warmly congratulating the Committee on the result of the year's work, pointed out that, in addition to the general improvements in the plant and premises since the appointment of the present Engineer, there had been enormous savings effected. It was also satisfactory to note that, while the total manufacture of gas had been less, the sales had increased to the extent of 4 million cubic feet; this being accounted for by a decrease in the leakage of over 9 million cubic feet. Though the undertaking had lost a customer for 8½ million cubic feet through the changes carried out in the Dockyard, the sale of gas to users of slot-meters had increased to almost the same extent, and the revenue from this source amounted to £12,000. He had been hopeful in the coming year of proposing a reduction in the price of gas; but the increase in the cost of coal would affect the next balance-sheet to the extent of several thousand pounds, which fact rendered it impossible to reduce the price. There would, however, be no increase in the price during the coming year.

DUNDEE GAS AND ELECTRICITY SUPPLY.

The Accounts for the Past Year.

The accounts of the Gas and Electricity Departments of the Corporation of Dundee for the year ending the 30th of April last have been issued. In the Gas Department there was an income of £111,148, and an expenditure of £85,655, which left a balance of £25,493. Out of this provision is made for annuities, interest, sinking fund, &c., and there is then left a balance of £1644, which is carried to the account for the current year. The quantity of gas sold was 698,981,500 cubic feet. The net revenue from gas amounted to £85,089, compared with £84,871 in the previous year. Coke realized £12,904, against £10,969; sulphate of ammonia, £9030, against £8497; tar, £3124, against £3118; and the net revenue from coal-waggons was £999, against £1098. The total revenue in the previous year was £108,544; so that the increase was £2604. The cost of the manufacture of gas was £65,317, against £59,707. The increase was mainly due to the rise in the price of coal and to the enhanced value of purifying materials. Distribution of gas cost £10,298, compared with £12,477; rents, rates, and taxes amounted to £6257, against £6711; and management to £3783, against £3896. The total expenditure of £85,655 was £2863 more than that of the previous year. The quantity of coal used during the year was 69,163 tons; and there was used also 383,711 gallons of oil for carburetted water gas as well as 79,135 gallons of benzol for enrichment. In all, 665,797,880 cubic feet of coal gas and 93,350,000 cubic feet of carburetted water gas—a total of 759,147,880 cubic feet—was made. The quantity of gas yielded per ton of coal carbonized was equal to 9626 cubic feet. The output of coke was 39,724 tons. The total manufacturing charges were £51,050, which is equal to 1s. 4·14d. per 1000 cubic feet of both coal and carburetted water gas made. There are 10,823 cooking-stoves and similar appliances in use, exclusive of such articles belonging to consumers; being an increase of 5039. There are 33,547 ordinary and 12,585 prepayment meters in use.

In the estimates for the current year, provision is made for the production of 789,577,800 cubic feet of gas, at a cost of £61,526, equal to 1s. 6·7d. per 1000 cubic feet of both coal and carburetted water gas. It is proposed to retain the price of gas at 2s. 6d. per 1000 cubic feet. At this figure, the estimated revenue from gas is £88,654; from residual products, £27,666; and from coal-waggons, £1030. Manufacturing charges are put down at £61,526, which includes £48,811 for coal—an increase of £10,328. The other estimates are: Purifying charges, salaries, repairs, and labour, £12,575; distribution, £7380; rents, rates, and taxes, £6143; management, £3810; and annuities, interest, sinking fund, &c., £25,784. The total expenditure would thus be £117,219; and the surplus anticipated is £1777. Benzol is reckoned to cost £797 more than last year; but on carburetted water gas a saving of £1145 is expected. Having regard to the amount expended last year, and the care exercised in working, a marked saving is looked for under the heading of retorts and settings. Last year the cost was £2358; and the estimate for this year is £1050. There will also, for the same reasons, be diminished charges for main and service pipe repairs, last year's actual cost of £4073 being reduced, in the estimate, to £2200.

In the Electricity Department, the revenue last year was £31,109, against £30,922 in the previous twelve months; and the expenditure £20,816, compared with £21,446. There remains a balance of £10,292 to be carried to the net revenue account. After meeting interest, sinking fund, &c., there is a balance of £914 to be carried to this year's account. The estimates provide for a revenue of £31,645 and an expenditure of £30 530; the expected surplus being £1115. In the estimates, provision is made for the payment of £800 as interest, and the placing of £700 to the sinking fund, to meet the first charges for the new generating station. The cost of coal has risen to the extent of upwards of £1500. Machinery and plant repairs last year cost £4197. These are now estimated at £1500; the saving being due to the fact that the plant has been excellently maintained, and that, having regard to the erection of a new station, further expenditure upon the existing works may be greatly restricted.

No Public Lighting for Lancing.—Lancing does not, it seems, feel the need of any street lighting, for at a recent public meeting a resolution in favour of the adoption of the Lighting and Watching Act was lost by 40 votes to 11—the result being received with cheers. The scheme was to provide 40 lamps, at an outlay of £200, to be raised by loan. It was stated that the cost of laying the mains where none at present existed would be over £400; but on this the parish would only be required to pay 7½ per cent. initial interest (about £32), which would immediately begin to decrease according to the consumption of gas, and be wiped out altogether when a sufficient amount was used. The cost of the gas would be £1 8s. 5d. per lamp per annum—a total of £56 18s. 4d. for 40 lamps, to which the wages of a lamp-cleaner, &c. (£26 a year), would have to be added. There was an alternative scheme for the provision of 21 lamps where there were mains already. One speaker contended that the scheme for 40 lamps would entail at least a 9d. rate, which, with the water scheme in hand, could not be entertained. For an installation of ten lamps, which he suggested as a proposal more likely to find favour, a rate of 2½d. would be sufficient.

LEEDS GAS PROFITS AND COAL PRICES.

A statement made to the Leeds Gas Committee by the Chairman (Mr. George Ratcliffe), regarding the working of the undertaking for the year ending March 31, was to the effect that there was a gross profit of £102,433. Interest charges amounted to £54,234, leaving a net profit of £48,199. From this sum, £31,705 had to be deducted in respect of redemption fund—showing a surplus profit of £16,494, or £1494 above the estimate. The profit for 1905-6 was just over £17,000. Considering the difficulties of obtaining prompt supplies from the collieries in the winter, and the consequent removal of coal from stock at much expense, together with the enhanced price of some of the coal purchased during the year, the surplus profit was looked upon as being very satisfactory by the Gas Committee, who unanimously passed a resolution complimenting the Chairman and the General Manager (Mr. R. H. Townsley) upon the result.

With regard to the current municipal year, tenders sent in to the Committee for 150,000 tons of coal to be delivered over the twelve months show advances ranging from 2s. 6d. to 4s. per ton; but none of these have been accepted. At the different works there is said to be sufficient in stock to meet the requirements for some time to come, as heavy purchases were made when prices were low; so that the Committee are now content to adopt a waiting policy. Meanwhile, they have empowered the Coal Purchasing Committee to negotiate when they think it advisable to do so. For the present, at any rate, no increase is to be made in the price of gas, though it is recognized that subsequent events may possibly necessitate a change being made.

INCREASE IN PRICE AT SHIPLEY.

The Gas Committee recommended, at last week's meeting of the Shipley Urban District Council, that, in view of the increase in the price of coal, representing an additional revenue charge of £2000, the price of gas be increased from 3s. 4d. to 3s. 6d. per 1000 cubic feet, with a reduction in the discount from 5d. to 4d.; and that the charge for street lighting be advanced from 2s. 6d. to 2s. 8d. The Clerk (Mr. Isaac Lindow), however, pointed out that it had been found that it would be very inconvenient to calculate the price on the basis of 3s. 6d.; and it was suggested that the price should remain at 3s. 4d., but that the discount should be reduced from 5d. to 2d. Mr. Shaw moved the adoption of the minutes as thus amended; while Mr. Roberts asked whether the Committee had carefully considered the effect upon prompt payments by the reduction of the discount, and Mr. Hill thought that they ought to encourage the consumption of gas. Mr. Shaw replied that the Committee had considered the question of discount, and thought the proposed alteration would make no difference to the prompt payment of accounts. The minutes were then adopted.

It was stated that the Finance Committee had had before them a letter from the Local Government Board to the effect that the sum of £31,000 received from the Bradford Corporation for the Heaton gas rights could not be used in part payment for the Saltaire gas rights without an amendment of the Shipley Act of 1904. Unless the Act could be amended by Provisional Order, the amount would have to be repaid within a period of thirty years, instead of forty years, as allowed by the Act of 1901. The Committee agreed by nine votes to eight to apply for a Provisional Order; and their minutes were adopted by the Council.

BLACKPOOL CORPORATION GAS SUPPLY.

Dealing with the gas-works in his report on the financial position of the Blackpool Corporation during the past year, Mr. W. Bateson, the Borough Treasurer, says the income amounted to the sum of £83,497. Deducting from this the expenditure of £55,118, leaves an available balance on the year's working of £28,379. This has been dealt with as follows: To reserve fund, £2102; interest and sinking fund, £11,196; in relief of rates, £15,081. The estimated available balance, after deducting loan charges, &c., was £16,102, against an actual return of £17,183. The total expenditure on revenue account was £55,118, as against £53,102 for the preceding year. The quantity of gas made was 512,901,000 cubic feet; being 3·65 per cent. in excess of the previous year. The quantity of gas used by private consumers and in public lighting in the borough was 489,869,600 cubic feet, against 474,768,900 cubic feet for the previous year, or an increase of 3·17 per cent. In addition, there was 6,753,300 cubic feet used by private consumers and in public lighting outside the borough, at Bispham, &c., against 5,168,300 feet for the previous year, or an increase of 31·84 per cent. There are about 89½ miles of mains, 2170 street-lamps, and 3237 consumers (ordinary, 10,249; and prepayment, 2968). A large increase in prepayment meters has again to be reported, amounting to over 10·7 per cent., and 2 per cent. in cash. The small increase in cash received as compared with the increased number of meters is owing to the price having been reduced 5d. per 1000 cubic feet. The total gas capital outlay charged against borrowing powers amounts to £210,642. Towards the redemption of this sum, there are accumulated sinking funds of £58,389.

Successful Year at Stourbridge.—The Stourbridge Gas Committee have reported to the Urban District Council that the past year has been a most successful one for the department; the gross profits being £11,714. After paying off the amount of principal and interest due, there is a surplus of £3100—of which 75 per cent. will be available for the relief of the rates. It may be remembered that a few weeks ago an agreement was arrived at that the proportion so disposed of should in future be 75 instead of 50 per cent.

SOUTH AFRICAN LIGHTING ASSOCIATION, LIMITED.

Success of the Prepayment Meter—Falling Capital Charges.

The Ordinary General Meeting of the Association was held last Thursday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. D. Ford Goddard, M.P., in the chair.

The Secretary (Mr. William Cash, F.C.A.) read the notice convening the meeting, the minutes of the last general meeting, and the Auditor's report. The Directors' report and accounts—noticed in last week's "Journal," p. 604—were taken as read.

The Chairman said he did not think there was very much in either the report or the statement of accounts that called for many remarks from him. The circumstances in South Africa continued somewhat depressing. Trade was seriously affected; and therefore it was with some confidence that the Directors saw their own business was maintained, notwithstanding that almost every other business in Port Elizabeth had shown some diminution. The gas sold in the past year was practically the same as in the previous year. The Association had lost some considerable amount through the withdrawal of public lighting by gas, because, as the shareholders knew, the Municipality were now supplying electricity in Port Elizabeth, and were undertaking some of the public lighting. They had also lost a good deal of consumption in connection with the public offices. Where they did not use electric light, they had not had occasion to work such long hours, and so required less gas. There was a slight falling off, too, in the quantity of gas taken by the ordinary private consumers. These reductions had, however, been made up—more than made up, he thought he might say—by the increase in the prepayment meter consumption. He regarded this, on the whole, as a very satisfactory position, because it extended the basis of the Association's operations. It increased the number of their consumers—and this among a class who were not likely to take electric light, and therefore might be looked upon as permanent customers. For this result, he thought they must pay a tribute to their Manager out in South Africa (Mr. W. Arnott), who was very active in getting so large an increase of consumers on the slot-meter system. At these meetings he had generally taken the opportunity of saying something in the way of comparison, so as to show how the works and business were progressing. During the last ten years, the capital expended by the Association had increased from £61,818 to £106,378—that was an increase of 72·8 per cent. In the same period of time, the sale of gas had increased by nearly 117 per cent. It was a very encouraging feature of their business that, while they were raising their output of gas, they were at the same time diminishing the amount of capital required per million cubic feet sold. In fact, within the period he had named the capital expenditure per million cubic feet of gas sold had decreased by £317. Of course, this reduction had also the advantage that it decreased the amount of dividend and interest payable per 1000 cubic feet of gas sold; there being a reduction of cost to the undertaking for dividend and interest of 6d. per 1000 cubic feet sold, which was a material advantage, and all to the good of the business. The number of consumers had increased, as he had already stated, during the year. He thought it was the largest increase of consumers they had ever had in any one year. Up to this time, the biggest increase was 358; but in the year under review there were 566 new customers, and though they were only small consumers, and had involved a good deal of labour in putting in new services and that sort of thing, their acquisition must in the end be to the advantage of the business. There had been practically no reduction in the price of gas during the year under contemplation. The price of coal had been slightly under at Port Elizabeth, and slightly more at Grahamstown, than was the case in the previous year; but it was really about the same, though they were aware that the price of gas coal had gone up considerably in this country. Naturally, the Association would have to pay more for their coal; but the Directors were rather hoping, by means of some new arrangements, not to materially increase the cost to their undertaking. They thought the freight could be reduced so as in some degree to counterbalance the increased price of the coal. As regarded the works operations, the manufacturing results were better than before, there having been an increase of 300 or 400 cubic feet of gas per ton of coal carbonized. This was all on the right side. They were now making 10,281 cubic feet per ton. One branch in which the Board had taken a large amount of interest, and to which great energy was being devoted, was the cooking-stove department. They had had lecturers out in South Africa showing the advantages of using gas for cooking; and the Directors had given special consideration to the terms on which they could supply gas-stoves. The result had been that they had now 1212 cooking-stoves in use, as against 737 in the previous year—a very wholesome advance in this connection. There was one matter in the report to which he thought he should just draw the attention of the shareholders—the paragraph alluding to the reserve investments of the Association. These, like all other investments, had depreciated in value; and the Directors thought it wiser to write them down in consequence. Therefore they had dealt with them on the present occasion by applying £500 towards their depreciation, which reduced them more nearly to the current value. He did not know that there was anything further in the report or accounts to call for remark; but he must express his regret—which he was sure would be shared by all present—that Mr. Corbet Woodall, their respected Engineer, was not able to be with them that day. He concluded by moving the adoption of the report and accounts.

Mr. Andrew L. Don seconded the motion.

Mr. Mitchell pointed out that there was a new item in the accounts—"Meters, stoves, and fittings on hire." He asked whether this was included in the "Stocks" in previous years. The two items together came to £8000 or £9000 more than was the case last year. He hoped values were being duly written-down.

The Chairman answered that the new item was previously included in "Stocks;" but the Board thought it was better to show this separately. As to the writing-down of stoves and fittings, this was a matter he had always taken a great interest in, because he was aware that it was one of those things that, if not looked after very closely,

was apt to become a serious danger. They had constantly written off in regard to stores of this nature. It was a most important point. Of course, a large part of the variation in the item of stores was due to coal. Situated as they were, they could not keep their coal always right. Sometimes they got two vessels in at once, and then they had a large stock. It was in the direction of lessening these stocks that they hoped to secure some considerable saving in the future.

The resolution was carried unanimously.

Mr. HENRY WOODALL proposed, and Mr. J. MACALISTER seconded, that a dividend of 10 per cent. per annum, free of income-tax, be declared—less the interim dividend already paid.

The CHAIRMAN remarked that they had fairly earned the dividend; and there was no reason why the shareholders should not have it.

This was agreed to.

Mr. Don was afterwards re-elected a Director, on the proposition of the CHAIRMAN, seconded by Mr. MITCHELL; and then the Auditor (Mr. Percival D. Griffiths, F.C.A.) was similarly re-appointed, on the motion of Mr. WHILE, seconded by Mr. R. B. FITZMAURICE.

Mr. A. W. OKE proposed a vote of thanks to the Chairman and Directors; remarking that it was gratifying to find that, though trade was depressed at the places where the work of the Association was carried on, the Board were able to put before the shareholders such a very satisfactory balance-sheet that day. He was also pleased to hear that during the past few years, through the careful management of the Directors and the officials working under them, it had been possible to largely reduce the capital per million cubic feet of gas sold.

Mr. MITCHELL seconded the proposal, remarking that the accounts showed the business had been properly looked after by the Directors and by the officials, who also deserved their thanks. As to the reduction in capital per million cubic feet of gas made, and consequently in dividend charges, there was no better proof than this fact, to anyone who understood the accounts of a gas company, of the inherent stability of the Association.

The CHAIRMAN, in returning thanks, on behalf of himself and the Board, said he did not wish to err on the side of being either too sanguine or too depressing. Sometimes the reports which came through telling them of bad trade made them feel rather sad; but, on the other hand, they felt that they were doing the very best they could with their opportunities, and they were satisfied that they were holding their own under these conditions. He was glad it was suggested to move a resolution with regard to the staff, because the Board felt that this was a useful and appropriate recognition of a greatly valued service.

Mr. WHILE then proposed a vote of thanks to the officials.

Mr. F. R. SMITH, in seconding, remarked that he knew Mr. Arnott; and a more energetic and capable man he thought it would be impossible to find. As for Mr. Cash, he was one of the best of Secretaries.

The resolution was carried; and the meeting then separated.

CAPE TOWN AND DISTRICT GASLIGHT COMPANY.

Trade Depression—Improving the Undertaking.

The Ordinary General Meeting of the Company was held on Friday, at the London Offices, New Broad Street House, E.C.—Mr. J. E. LILLEY in the chair.

In the absence through indisposition of the Secretary (Mr. H. Yuill), Mr. BLACKBURN read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The report stated that the result of the year's working to Dec. 31 was a profit of £14,844, to which had to be added the sum of £1356 brought forward from the previous year's accounts, and a sum of £5000 transferred from the reserve and contingency account—making a total of £21,200. After providing for the debenture and debenture stock interest and the dividend on the preference shares, there remained a sum of £8058. Of this amount, £4000 had already been paid to the ordinary shareholders, at the rate of 8 per cent. per annum for the half year ended June 30, 1906. The Directors recommended the payment of a final dividend on the ordinary shares at the rate of 6 per cent. per annum for the half year ended Dec. 31, making a distribution of 7 per cent. for the year. This would leave £1058 to be carried forward.

The CHAIRMAN said that when they met last year, the Company's district in Cape Town, and indeed almost the whole of South Africa, was suffering from very severe depression; and he was sorry to say the same condition still existed. Naturally, for many people the results became more serious the longer the depression continued. A large number of the Company's customers struggled on as long as they could, but at last reached the final point of their financial endurance, and had either had to leave the district altogether or to remove into less expensive houses. This, of course, had adversely affected the trading of their undertaking, as well as that of other concerns. The Directors did not sit down satisfied with the condition of affairs, but had sought in every direction they could think of for opportunities of increasing their customers, improving their methods, and making savings in expenses. They had succeeded in making some savings, though not to the extent to which they had lost business up to the present time. When they met the shareholders last year, they were in the expectation of very large savings in expenses. They had just started a scheme for manufacturing all their gas at one station—Woodstock—instead of partly at Woodstock and partly at Cape Town. Further manufacturing plant was needed; and they had then provided a water-gas plant, which they knew would amply supply any deficiency as to quantity, while they also had good reason to believe it would be satisfactory in every way as regarded quality—that opinion being based on the experience of some of the best undertakings in this country. But the conditions of temperature in South Africa affected the stability of water gas, so that the Board were not able to look on it as a gas that they could rely upon to the full extent they would require for the whole of their large district. They spared no pains to enrich it; and they got the full benefit of the enrichment in the gas. But the change of temperature from the holders—heated by an African sun which was sometimes 110°—to the cooler temperature of the pipes underground, caused it to lose, as it travelled to some of the more distant parts of the district, some of its illuminating and calorific properties. As there were over 100 miles of mains, and some were about 10 miles distant from the works (even taking the works as not being at the extremity of the district, which really covered from 15 to 20 miles from end to end, besides various ramifications), this was a matter of serious importance; and the Directors decided that they could not rely upon water gas as a sufficient substitute for coal gas to the extent that was necessary to enable the Company to supply all their gas from Woodstock. They also found that, in order to send the gas to districts far away, it was requisite to lay a larger main to connect up some parts of the area. They at once set about doing this; and the work was now well on towards completion. Then they saw that they must increase the gasholder capacity in Cape Town; and they decided to renew one of their holders there, and to enlarge it at the same time, which work was now nearing an end. They would overcome the difficulty with regard to the greater quantity of coal gas required by adding to the retort capacity at Woodstock. They proposed to put in modern retorts, which would save considerable sums of money in labour and fuel; and, with other economies contemplated, it was calculated there would be a saving of a few thousand pounds a year when they could bring the one works into use instead of two. The short experience they had had of the working of the Woodstock station only, proved this. The Directors proposed to meet a good deal of the expense of what they had done, and what they were going to do, out of revenue, instead of out of capital. They would create a suspense account for the purpose, and apportion to it so much every year out of the savings they knew they would secure. He had told them that search was made in every direction for opportunities to improve the Company's administration, methods of manufacture, &c.; and they had thought it better, as no member of the Board had visited Cape Town recently, to send out some independent person with practical experience of gas making, with technical engineering knowledge, and with a knowledge of administration. Looking round, they came to the conclusion that the best man they could send was Mr. J. L. Chapman. He had known Mr. Chapman for many years; and he had been highly successful in the conduct of a gas-works about the same size as, or rather larger than, their own. Mr. Chapman had manufactured gas at his works at, he (the Chairman) thought he might safely say, almost the lowest rate of expenditure of any gas-works in the kingdom. He was also a shareholder with a good stake in their Company; and it would therefore be to his interest to advise the Board to the very best of his ability. In addition to this, he knew him to be, and all who came in contact with him knew him to be, a thoroughly honest and capable adviser. The Directors asked him to undertake the work; and they were very glad indeed he accepted the responsibility. He had been to Cape Town, and had thoroughly inspected the whole district and everything. He very strongly advised that all the gas should be made at Woodstock, and that it was quite certain they would, as they had contemplated, make a large saving thereby. He was also pleased to say that, having seen the Company's officials at work—particularly the Manager (Mr. E. P. Reilly) and the Local Secretary—Mr. Chapman spoke of them in the highest terms, as being thoroughly zealous and competent. The Board were very glad indeed to have their own opinion of the officials confirmed in this manner. The shareholders would remember that during the year 1905 an explosion occurred in Cape Town which did some damage to the Tramway Company's property. The Tramway Company sued the Municipality of Cape Town and also their own Company jointly for damages for this injury; and he regretted to say that they, with the Municipality, were held liable. The Tramway Company blamed the Municipality because the sewers belonged to them, and their Company because they said it was the gas that did the damage. As the result, it had cost their Company nearly £2000 for damages and costs; and they paid this. Immediately the decision was given, several other people commenced to formulate claims, some of which could not but be regarded as unreasonable. These were carefully sifted; and he thought that all except two had been settled, while these two were in course of settlement. It was hoped that the total sum involved in these claims would not exceed £500. During the past year, the Company had been subjected to very keen competition indeed from the Municipality, who had for a long time been supplying electricity in Cape Town. Now according to the figures publicly stated in Cape Town, the cost of electricity to the Municipality was 3 7d. (practically 3⅞d.) per unit—that was its cost to produce. Nevertheless, the Municipality supplied electricity in competition with the Company's gas for power purposes at 3d. per unit, not only in Cape Town, but outside their own district. Some of them might think this was entirely beyond the powers of the Municipality. He himself thought so; but though he had looked into the matter, he was not yet able to substantiate his opinion. This policy, of course, must result in a considerable loss. For lighting the streets of Cape Town—for which the Gas Company were not allowed to compete—the Municipality charged a price 80 per cent. higher; and this naturally helped to make good the loss on the current sold for power. The Gas Company, as ratepayers, had to provide some of the money necessary to meet the loss that was incurred by the Municipality through competing in what he could but regard as an unfair manner with them. If the Gas Company were allowed to light the streets of Cape Town, they would be prepared to do it as well as, or better than, now, and certainly at a less cost; but though they had offered to do this, they were not permitted to. They seemed to think that the Gas Company made very large profits. It was noticed that the Company paid 10 per cent. on the shares; but people failed to realize that if the return was reckoned on the whole of the capital, including the debentures, it only worked out to a little over 5 per cent. There were very few Colonial investors who would be satisfied with this rate of interest. He might mention that rates and taxes and import duties added 1s. per 1000 cubic feet to the cost of gas in Cape Town; and this, of course, prevented them from lowering the price quite so much as they would otherwise do. It was mentioned in the report that the Company had sold less gas during the past year. In the early part the number of consumers was dwindling gradually, and causing the Directors most serious anxiety. Some of the houses that were vacated remained empty; but the tenants of those that were re-let they did their best to secure as customers. Their rule, however, was that they

must have a deposit as security for the credit they had to give; and this necessity for a deposit caused many people to refrain from becoming consumers. Yet the Company dared not give credit without some sort of security, because their experience of bad debts had previously been considerable. They therefore decided to offer advantages to customers who used prepayment meters, and determined to reduce the price of gas taken through these meters nearer to the charge made to ordinary consumers. When the Directors arrived at this decision, they advertised and canvassed for customers, with the result that by the end of the year they had fully recovered in number all the consumers they had at the beginning. The amount of money, however, expended by each customer—whether through ordinary or prepayment meters—was less than it used to be. The Board could not, however, help feeling that this increase in number must tell. There was another thing, too, which tended to make the sales of gas rather less last year. Legislation took place which compelled all the shops to close early; and therefore there was not so much gas needed. As to coals, he might say, they had fortunately a very good contract, secured when coals were cheaper, and therefore they got their supply last year at about the same price as previously; and the contract which was still running would provide them with coal at the same price to the end of the present year. They had taken great pains in searching for suitable Colonial coal; but so far they had not been able to find anything that would enable them to make gas at anywhere near the price they could now do, though coals of almost all other descriptions, and of excellent quality, could be obtained. With regard to residuals, the receipts for these were again smaller, though they had sold much more. As to the current year, of course, they would go on in the direction he had mentioned—arranging to make all the gas at Woodstock. He believed Mr. Chapman would confirm him in saying that they would save from £3000 to £4000 a year in labour, fuel, and repairs. Since the beginning of the present year, he might tell them, they had gone on increasing the number of consumers steadily month by month at a satisfactory rate. The officials were working hard, and devoting all their energies to increasing the business; and certainly they had been very successful. The Government Education Department had lately added to their school curriculum the teaching of cookery; and for this purpose a gas supply was required. Lectures were also being given publicly; and they were creating very great interest. When matters revived, as he thought they would before long, and South Africa settled down to normal conditions, he believed there would be a return to even greater prosperity than before. As to the capital expenditure, a very considerable proportion resulted from the necessity of laying new mains, of which they put down about 4½ miles last year; and besides this there were various additions and improvements to the works. The Directors had decided during the present year to reduce their fees; while the Managing-Director had also resigned his position, and become an ordinary Director. The Manager in Cape Town, too, had voluntarily relinquished a portion of his salary. The various savings definitely effected under these heads came to £950 a year, or almost 1 per cent. on the ordinary capital of the Company. The Chairman then referred at some length to the advantages of gas over electricity, and concluded by moving the adoption of the report and accounts.

Mr. H. R. SAVORY seconded the motion.

Mr. J. L. CHAPMAN then gave a short account of his visit to the Company's property and his suggested improvements. He said that he went over the works; and as far as the officials were concerned—that was Mr. Reilly and the Local Secretary—he did not think it would be possible to find better men. He was very much struck with the manner in which they "put their shoulders to the wheel." The arrangement of the lectures for disseminating a knowledge of gas cooking, the Manager had taken wonderfully in hand; and the result, he believed, was going to be a great success for the Company. With regard to expenditure, they were able to go into many matters together which he felt sure would bring considerable profit to the Company. The cost of labour out there—especially the artizan and the skilled labourer—was very great, in many cases 100 per cent. more than in England; and he (Mr. Chapman) made some suggestions whereby they could get more work out of the skilled labourers than at present. There were other points they went thoroughly through; and he believed the result would be profitable to the Company. But at the present moment there was great depression in Cape Town; and it was felt throughout the Colony. This, however, would not affect the Gas Company in the long run. They were now going in for the poorer class of consumer. He thought there was an increase of about 800 consumers up to May 1 this year, which was very satisfactory; and this was the way that the Company would have to go on to obtain better results. But the great question was the removal of the gas-works at Cape Town to Woodstock. Perhaps some of those present would wonder why this was not taken in hand before; but there were many difficulties in connection with the concession. The Board therefore thought it would be wise not to move before the concession had come to an end, or had been satisfactorily settled. When he was in Cape Town, there was a meeting of the Corporation; and they passed a resolution that they would not interfere with the concession of the Company. Under this concession, he might point out, the Corporation could have bought the Company out by giving notice before June 30. Therefore they were now on strong ground; and the Directors, having laid a 16-inch main, were in a position to remove the works after June 30. His clear advice to them was to do it. There would be a small sum to spend on a retort-house; but the other plant was excellent. He had suggested in his report that by the adoption of this policy they would save £4000 a year; but he believed they would do still better when the scheme was in thorough working order. They must look to the Directors now to consolidate the Company. They should pay a fair 6 or 7 per cent. dividend for a few years to come, and work with the one purpose of making the Company a strong concern, able to meet the opposition of electricity or anything else that came along. As soon as the consolidation of the works was effected, the price of gas should be reduced a little continuously.

The CHAIRMAN said they had about 1625 cookers, against 416 last year. This showed that gas was becoming appreciated by the poorer classes. They would have to rely, there was no doubt, on a large number of small accounts, instead of a small number of large ones. Therein had been found the salvation of English companies; and he believed it would be conducive to their own prosperity.

The resolution was carried; and the retiring Director (Mr. H. R. Savory) and the Auditors (Messrs. C. F. Kemp, Sons, and Co.) were thereafter re-elected.

SANITARY ASPECTS OF THE USE OF GAS.

Lecture by Professor Lewes.

Last Wednesday evening, Professor Vivian B. Lewes, F.I.C., F.C.S., lectured to a highly interested audience, in the new lecture-room at the offices of the Croydon Gas Company, on "The Sanitary Aspects of the Use of Gas." There was a goodly gathering of ladies and gentlemen, who attended on the invitation of the Chairman and Directors of the Company to inspect the new offices and showrooms of the Company, and to hear the lecture.

Mr. CHARLES HUSSEY, J.P., the Chairman of the Company, in introducing Professor Lewes, gave a few figures to show the strides made by the Company in the development of its business since 1879. In that year, he said, they made 243 million cubic feet of gas; while in 1906 they produced 1200 million cubic feet, or five times the quantity. In 1879 they had about 4800 ordinary consumers, and none on the prepayment system, this not having been adopted until ten years later. Now they had 15,208 ordinary and 14,000 prepayment consumers. They had now on hire 17,100 cooking and heating stoves, compared with 44 at the former period. The length of mains in their district had increased from 60 to 230 miles. The staff, in the same period, had grown from 11 to 82.

Professor LEWES, having congratulated the Company on their enterprise, said that about thirty years ago, when the electric light was first coming into prominence, people who held gas stock passed through sad tribulation; many of them thinking of selling out on account of the wonderful blare of trumpets with which the new light had been introduced. With the aid of the incandescent mantle, they had now an illuminant which the electric light could not equal. Going on to compare the two lights, he said they found that, sitting in an electrically lighted room, they began to get a feeling of oppression and stuffiness which they did not get with gas; and it was really with this point, which struck at the hygienic root of illumination, that he wished to deal that night. The question of the hygienic properties of gas illumination was an extremely complicated one, which presented questions which were partly chemical, partly physical, and partly physiological. The lecturer then explained the composition of the atmosphere, and touched on some of the impurities found in the air. Coming to his proposition that gas lighting was a valuable aid in securing the ventilation of a room, which electric light was not, he explained that carbon dioxide, though heavier than air, did not sink, as many people imagined, because, being warmed, it became lighter than air. He explained the diffusion of gases and the carrying away, through the porous plaster of the ceiling, of the layer of hot foul air found at the upper part of the room. This diffusion was one of the greatest factors in keeping the air pure when they were using gas as an illuminant; and they never got the fouling of the air in the room going on to any great extent. In the case of the electric light, the amount of heat given off was so small that one did not get the hot currents which were so valuable for ventilation. Consequently, diffusion practically ceased, and the organic matter given off by the occupants of the room went on increasing until, when there were a large number of people, the organic contamination of the atmosphere became unbearable.

The lecturer demonstrated a number of his statements by simple and easily understood experiments; and the lecture, which was admirable for its lucidity, was heartily applauded. At the close, on the proposition of the Mayor of Croydon (Mr. H. K. Moore), seconded by Mr. Hussey, a vote of thanks was cordially adopted.

New Joint-Stock Companies.—The Sun Gas Company, Limited, has been registered with a capital of £10,000 in £1 shares, to acquire patents and other rights for improvements connected with the manufacture of acetylene or other hydrocarbons from carbide and by-products thereof. The British Cerofirm Company, Limited, has been formed with a capital of £120,000, in £1 shares, to acquire British patent No. 15,295 of 1906, for the manufacture of incandescent mantles, with patents or rights to patents for British colonies and dependencies, except Canada, and adopt an agreement with the Cerofirm-Gesellschaft of Berlin. The Standard Gas-Fittings Company, Limited, with a capital of £5000, in £1 shares, will acquire the business of gas and electrical fittings manufacturers carried on by Messrs. Rogers, Cooke, and Rogers, at Beaumont Works, Birmingham. There will be no initial public issue in the case of any of these Companies.

Croydon Water Supply.—Early last year, the ratepayers of Croydon rejected by a very large majority a scheme for improving the water supply of the borough, estimated to eventually involve an outlay of £250,000. The Water Sub-Committee of the Town Council resigned, and a Standing Water Committee was formed. On their behalf, fresh recommendations have lately been submitted to the Council: (1) To develop the present temporary supply obtained at Waddon; (2) to provide sand filter-beds at the Addington well; (3) to seek a fresh source of supply at Wallington or elsewhere. These projects are estimated to cost £40,000. Alderman Page, the Chairman of the Finance Committee, explained that the cost of the recommendations could be met without application to the Local Government Board or taking anything from the rates. It would come out of the water surplus and the revenue available on completing the paying-off of loans on certain water undertakings. The Committee's report was carried by a large majority of the members present.

THE FATAL SUFFOCATION BY GAS AT HOXTON.

Coroner's Inquest—Verdict of Accidental Death.

At the Coroner's Court, Shoreditch, last Tuesday, Dr. R. L. Guthrie, the Deputy-Coroner for the North-Eastern District, held an inquiry with reference to the death of Martha Choate (49), who was found lifeless in bed on Friday, the 24th ult., under circumstances recorded in the last number of the "JOURNAL" (p. 636).

Mr. BEASLEY ROBINSON (of the firm of Messrs. Monier-Williams and Robinson) appeared for the Gaslight and Coke Company, in whose district the fatality occurred; Dr. H. MANSFIELD ROBINSON, the Town Clerk of Shoreditch, represented the Borough Council; and Mr. COX-SINCLAIR was in attendance on behalf of the relatives of deceased.

Evidence of identification having been given,

Joseph Butcher, a workman in the service of the Borough Council, said the deceased had a room in his house. He left to go to his work at half-past five on the morning of the accident and then detected a slight smell of gas. He returned shortly after eight and found his wife and five children unconscious. With the assistance of some neighbours, he removed them to a neighbouring house in Louisa Street. He then, with assistance, broke open Mrs. Choate's door, and found her lying dead in bed. When he came home from work, the smell of gas seemed to proceed from a cupboard in his room. He had noticed a steam-roller going up and down the road.

Ellen Butcher, the wife of the preceding witness, said she was awake when her husband left to go to his work, but did not then detect any odour of gas. Her children afterwards came up to her room, and she did not remember anything more until her husband came home and found them unconscious.

Dr. *James O'Dwyer* said he went to the house about half-past eight on the morning of the occurrence, and found a very strong smell of gas in the hall. On being told that someone was in the back room, he burst the door open and discovered the deceased lying on the bed. He had made a *post mortem* examination, and found the organs fairly healthy. In his opinion, the deceased was poisoned by gas fumes.

Mr. *G. F. L. Foulger*, the Company's Chief Distributing Engineer, produced a plan of the premises as well as a piece of broken gas-pipe. He stated that, in his opinion, it was a perfectly good pipe, lying in the ground at the depth of 20 or 23 inches. There was no other pipe there. Personally he had no doubt it had been broken by the steam-roller which was at work on the road. The lower surface of the pipe showed tension, and the upper part compression. He could not suggest anything to avoid such an accident. It was one of the risks that had to be put up with if the road had to be consolidated. The Gas Company had an area of nearly 70 square miles; and the average number of breaks caused by steam-rollers would be about 20 a year. There was no regulation governing the depth of the pipe in the ground. The soil was a good average kind, quite sufficient to support the pipe.

In reply to Mr. BEASLEY ROBINSON, witness said he heard of the accident about a quarter past ten on the morning of its occurrence, and his assistants had gone at once to see to it. The Company had not had notice from anyone of an escape of gas.

Examined by Dr. MANSFIELD ROBINSON, witness stated that from his knowledge of gas-mains he should not have anticipated any danger from rolling a road with a main laid 23 inches below the surface; for sometimes pipes were as little as 6 inches below it. The Company had been in existence for upwards of a hundred years; but even this fact did not enable them to say exactly how long gas-pipes would last. It might be sixty years. Possibly some subsidence of the soil which would not be observable on the surface had caused the serious fracture in the present case.

Mr. *W. C. Wigley*, the Divisional Main Inspector, in corroborating the evidence of the last witness, said there was no particular system of inspection. Unless they had to interfere with the ground for any special purpose, it would not be opened for inspection without they had some complaint.

Mr. *T. H. Hustler*, the Engineer and Surveyor to the Shoreditch Borough Council, said that during the previous week they were repairing the surface of Louisa Street, scarifying and pitching it. They afterwards put down 2 inches of broken granite, and consolidated it with a steam-roller. He was not aware of the condition of the soil underneath. If he had known of a gas-pipe 23 inches deep, he should have had no hesitation in rolling. There were no trenches, and no danger whatever was anticipated. The road was steam-rolled last in July, 1901.

In answer to Mr. COX-SINCLAIR, witness said they had no minimum depth for pipes. Even if the pipe was only 8 inches below the surface, they would have felt it was safe to roll.

Mr. *H. W. Gammon*, a road foreman employed by the Borough Council, said he had carefully examined the premises in which deceased lived, with the view of ascertaining where the gas came from, and he found some brickwork just under the channel. There were cracks about an inch wide, and the bricks had been cut out, and not properly reset. The gas might have got in through the opening. He did not smell gas when he was at work there the day before the accident.

The CORONER having summed up the case, the Jury returned a verdict of "Accidental death."

On being asked if they made any recommendation, the Foreman replied "No."

Proposed Gas Extensions at Leek.—At the fortnightly meeting of the Leek Urban District Council, the Gas Committee recommended that application be made to the Local Government Board for sanction to a loan of £3000 on account of the following prospective extensions during the next two years: Meters, £1100; fittings, £200; mains and services, £500; stoves, £1200. They also recommended that the price of gas be advanced to 3s. per 1000 cubic feet, with a discount of 6d. for prompt payment; this being a rise of 3d. per 1000 feet. A long discussion took place upon the proposals, and the fact of there being an adverse balance on the gas account of £2613. Ultimately the matter was adjourned.

HARROGATE WATER-WORKS SCHEME.

Local Government Board Inquiry.

Major C. E. Morton held an inquiry on behalf of the Local Government Board at Harrogate last Tuesday, into an application by the Town Council for sanction to borrow £100,000 for the completion of the Roundhill reservoir, near Marsham, and other works authorized by the Harrogate Water Act, 1901.

The Town Clerk (Mr. J. T. Taylor) explained that the original estimate of the cost of the scheme was £325,000; but this had been found to be insufficient. On the Inspector inquiring whether there was any opposition to the application, Councillor Judge asked him to ascertain what were the wages paid to officials, and what was paid for actual work done on the site. Mr. W. E. Dixon (the Water Engineer) gave evidence to the effect that the additional cost of the scheme beyond the estimate was really due to the great depth they had had to go to get the foundation for the dam. In some cases the cost had been under the estimates; but in most instances the work had involved a larger outlay than was anticipated. This was estimated to cost £1995; whereas the actual cost was £16,475. The filling up of the trench was expected to cost £7020; and the actual figure was £40,200. The masonry below the dam increased from an estimate of £44,750 to an expenditure of £71,501. The land cost £16,000 more than estimated; the tunnel £6910 extra; and the two small settling reservoirs, £6283. Altogether, he calculated he would require an additional £100,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

We have reached what at present appears to be the end of the Edinburgh Brewery Well case (see p. 672) much sooner than I anticipated. Although the Commissioners have got the worst of the case, it is probably with a feeling of relief that they have reached what has every appearance of being the termination of a litigation which has lasted since the beginning of 1905. To have won the case would have been a pleasure; but to find, by exhaustive investigation, that they were, after all, the delinquents, and to acknowledge the wrong, was a duty which, honourably carried through, must be akin to pleasure. At all events, the minds of the Commissioners are now at rest upon the case, except in so far as the meeting of the necessary payments is concerned.

The annual accounts of the Dundee Corporation Gas Department, published to-day, show that the undertaking has had a year which is altogether satisfactory. It was estimated that there would be a production of 735,807,000 cubic feet of gas; and this estimate has been exceeded by 23,340,880 cubic feet. A year ago it was reported that there had been an increased production of over 26 million cubic feet. It is therefore apparent that the rate of increase is being satisfactorily maintained. A year ago the price was reduced by 2d. per 1000 cubic feet; yet the revenue from the sale of gas has increased by £268. The total revenue of £111,148 is £2604 up, as to which it is to be observed, from the summary of the accounts published in another column, that coke and sulphate of ammonia contributed largely, and tar very little. The ordinary expenditure of £85,655 was increased by £2818, mostly due to the increased cost of coal. This item is to be greater this year again, to the extent of over £10,000; but it is believed that, by a continuation of the economies which have been practised in the gas-works, it will be possible to continue the price of gas at the present figure of 2s. 6d. per 1000 cubic feet. Thus the record of the past and the outlook for the future are both encouraging.

The Edinburgh and Leith Gas Commissioners held their monthly meeting on Monday. In the minutes of the previous month's meeting, it was stated that the purchases of cannel coal amounted to 40,000 tons. The supply of meters for the year was let to Messrs. R. Laidlaw and Son, Limited, of Edinburgh, for 2 and 3 light dry meters, and Messrs. Alder and Mackay, of Edinburgh, for 5 and 10 light dry meters. Contracts for the supply of tubes and fittings, &c., were also let.

It frequently happens that, on removing from a house, the gas connections are not properly looked after, and there is some danger to the incomers, unless they are careful people. There was such an incident this week in a two-roomed house at No. 390, New Heppochill Road, Springburn, Glasgow. A gasalier had been taken away, and the end of the gas-pipe plugged up. This operation, however, had not been well done, and a painter who was sent to whitewash the house noticed a smell of gas. He was examining the pipe, for the purpose of which he foolishly struck a light, when a very violent explosion followed, which blew out the front and back windows, and threw down a partition wall. The workman was so badly burned about the face and hands that it was considered advisable to send him to the Royal Infirmary, where he was detained.

It is satisfactory to learn that, as the result of the very successful working of the Broughty Ferry Corporation gas undertaking by Mr. G. Keillor, the deficit in the gas finances of the burgh will be altogether wiped out. Fully four years ago it was ascertained that there was an adverse balance in the gas accounts of £4700. There was also a loss on the Electricity Department of £1100, which the Gas Department had to make good. The proposal was made to levy a gas contingent rate; but the price of gas was raised by 7d. per 1000 cubic feet instead. The Town Council had sold the Castle Green to the Government, and they proposed to apply the price to the extinction of the deficit—at least temporarily; but there was trouble with the Scottish Office over this method. The Secretary for Scotland allowed five years for the making up of the deficit. The Corporation have accomplished it in three years, which is very creditable indeed to the Manager and to the Gas Convener—Mr. J. P. Chrystal. At the beginning of the financial year just closed, there was still £1900 to pay. With the clearing away of the deficit, a reduction in the price of gas might have been looked for, and it may be realized next year; but for the current year the price of coal has risen so much that an additional outlay of £800

will be entailed. In addition, the large capital expenditure of former years has raised the standing charges in respect of capital by as much as 1s. 3½d. per 1000 cubic feet. With so large an increase in price, the consumption of gas went down from 64 million cubic feet to a little over 58 millions two years since. But a twelvemonth ago it had begun to pick up again; and during the past year there was an increase of 2½ million cubic feet, which is attributed largely to the extended use of gas for cooking and heating.

The Watching and Lighting Committee of the Perth Town Council had before them yesterday the annual financial statement regarding the work done. Bailie Young, the Convener, said he thought it would be admitted that in the past year the lighting of the streets had been very much improved, and it was gratifying to know that this had been effected at a great saving to the ratepayers. The total expenditure upon lighting was more than £800 less than the sum estimated; while the estimated revenue had been exceeded by £130. A vote of thanks was accorded to Bailie Young for his economical and efficient working of the department.

The Aberdeen Corporation Gas Committee agreed upon their coal contracts for the year on Tuesday. Tenders were opened and accepted for 69,000 tons, at a total cost of £62,946; the average price being 18s. 2d. per ton—an increase of 2s. 6d. per ton over the prices contracted for a year ago.

The disadvantage which is sometimes experienced in the working of a gas undertaking with only one gasholder was exemplified by an incident which occurred at Monifieth on Thursday evening. The works are the property of the Corporation. The one gasholder they have is supported by steel wire ropes. Between seven and eight o'clock one of these ropes snapped—said to have been a purely accidental occurrence—and the holder tilted over and jammed. So far I have not seen any account of gas having escaped; but the supply was affected. The Manager—Mr. W. R. Lawson—telephoned to Dundee for assistance, and Mr. A. Morton Fyffe, the Assistant-Manager there, went over. As a result of his consultation with Mr. Lawson, arrangements were made for giving a supply at a reduced pressure. The work of rectifying the mishap will be started at once, authority for which was given by Provost Stewart and Bailie Fenton, the Gas Convener, who were present.

The Glasgow Corporation on Thursday agreed that the water-rates be continued as at present. Mr. Watson, the Convener, said there was nothing unusual in the financial statement, except that they were spending a very large sum annually in the repair of the old aqueduct, which would cease after next year. Mr. W. F. Anderson pointed out that the estimate showed an expected debit balance of £3540. This he thought was not business. They ought to make their accounts square, which could be easily done if they put an additional penny on the rates in some districts. Mr. Watson replied that it was estimated that £13,500 would be expended during the year in repairing the old aqueduct, and £3000 in relaying part of the Gorbals main. These outlays would not be repeated, and they were quite ample for the wiping out of the deficiency.

In the Court of Session on Tuesday, Lord Mackenzie gave his decision in an action brought by Mrs. Murray Jardine, proprietress of the estate of Granton, Dumfriesshire, against the Corporation of Moffat. Declarator was sought that the Corporation were not entitled to supply water derived from the estate of Granton except to premises for the time being within the burgh of Moffat. The pursuer maintained that the right of the defenders was to draw water from her estate for all purposes authorized by the Act of 1862, and that, according to the disposition in favour of the burgh, "any water, after the water for the time being is taken, shall be allowed to overflow, and shall belong to, and be at the disposal of, the proprietors and tenants of Granton." It was averred that water had been illegally supplied by the Corporation to premises outside the burgh, and rates collected therefrom. The Corporation replied that on a true construction of the disposition, they were not restricted to a supply to premises within the boundaries of the burgh; the expression "town of Moffat" meaning something wider than the burgh; and that even if under the Act of 1862 they had no right to supply water outside the burgh, that right was conferred upon them by the Burgh Police Act of 1892. Lord Mackenzie gave declarator as concluded for, with expenses; but, considering the serious effect which the interdicting of a water supply would have, he superseded that part of the pursuer's crave.

Gas Explosion at a Church.—St. Leonard's Church, Bilston, was last Sunday week considerably damaged by a gas explosion, which is believed to have occurred through a leakage from one of the pipes, causing gas to accumulate round the lamps situated high up in the building. At the time of the occurrence, the verger was engaged in lighting up for the evening service. One stained-glass window which was destroyed is said to have cost about £500. The edifice is insured; and it is hoped that sufficient money will be derived from this source to cover the damage. In order to secure any deficiency, however, a restoration fund has been opened.

Free Gas in Non-Provided Schools at Oldham.—Mr. Arthur Andrew, the General Manager of the Oldham Gas Department, has reported to his Committee that some caretakers of non-provided schools have been using the gas which is supplied free to the Education Committee for other purposes. There were, he said, two meters in the non-provided schools—one for gas supplied free to the Education Authority, and the other for meetings, &c., held after school hours—and the change from one meter to the other was left in the hands of the caretakers. He had reason to believe the caretakers at some of the schools had not carried out their duties in this respect; and the gas passed through the Education Committee's meter had been used for other purposes, with the consequence that there was a loss of revenue to the Committee. He knew of four such cases in two schools. He had found scarcely any gas registered through the meter which should be paid for, and on making inquiries learnt that the caretakers had neglected their duty. Mr. Thompson remarked that there was a great wastage of gas all through the schools. The Chairman said it was human nature. If the caretaker knew he could get gas free, he would do so. It was decided to write to the Secretary of the Education Committee, asking him to warn the caretakers.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 1.

Sulphate of Ammonia.

Throughout the week demand has been sustained, and prices have gradually hardened; so that at the close the quotations are £11 16s. 3d. per ton f.o b. Hull, and £12 f.o.b. Liverpool and Leith. The Continent has not responded to the advance in the United Kingdom, German production being still freely offered; but diminishing production from gas-works has made itself felt upon supply, which is nowhere abundant in the United Kingdom. Business in the forward position has been checked by the advanced ideas of producers, for, although £12 per ton has again been accepted for July-December delivery, £12 2s. 6d. per ton is now required. For delivery over the spring months, £12 5s. per ton is being quoted f.o.b. Leith.

Nitrate of Soda.

This article is being freely offered on spot; and the closing quotations are 10s. 7½d. per cwt. for 95 per cent. and 10s. 10½d. for refined quality.

LONDON, *June* 1.

Tar Products.

Markets have been steady during the past week; and in most cases prices have been well maintained. Pitch is very firm for forward delivery, though there does not appear to be much business doing, as in most cases manufacturers' ideas are considerably above the prices which dealers can offer, in view of the situation on the Continent. For prompt delivery, business is practically done for the session, though small parcels still continue to be placed from time to time at about the ruling prompt prices. Creosote is firm all round; and on all sides makers seem anxious to remain out of the market at present, unless they can get a very good price. Some quantity of London oil is reported to have been sold at 2⅝d.; but, in most cases, manufacturers ask from 2⅝d. to 3d. In the Midlands, 2⅞d. to 3d. per gallon has been asked; while in the North the ruling price appears to be about 2½d. Benzol, 90 per cent., is quiet and depressed; and 9d., delivered to consumers' works, casks included, has been accepted in London during the past few days. Toluol and 50-90's benzol are both quiet; and there is little demand for same. Solvent naphtha is quiet in the North, where one or two second-hand parcels have been rather pressed into the market for prompt delivery. In London, however, it is still firm, as there is a moderate demand for actual London makes, and makers are well sold. Carbolic has been more firm during this week than was the case a little while ago—doubtless owing to dealers having covered themselves to some extent for the quantities which they were oversold. Crystals are without interest, and there is not much business in them. There is no alteration in the market for anthracene. In naphthalene, prices are still very firm, and any parcels which come into the market are readily taken up at full market value.

The average values during the week were: Tar, 15s. 6d. to 19s. 6d. Pitch, London, 26s. 6d. nominal; east coast, 25s. 3d. to 25s. 6d.; west coast, 24s. 3d. to 24s. 6d. Benzol, 90 per cent., 8½d. to 9½d.; 50-90 per cent., 9½d. to 10d. Toluol, 1s. 0½d. to 1s. 1d. Crude naphtha, 4¾d.; solvent naphtha, 1s. 1d. to 1s. 3½d.; heavy naphtha, 1s. 2d. to 1s. 4d. Creosote, London, 2⅝d. to 2¾d.; North, 2½d. Heavy oils, 3d. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8½d. Naphthalene, £6 10s. to £10 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

This article has been steady during the past week, and prices appear to have been gradually hardening all round. The principal London Gas Companies still quote £12 2s. 6d., and report that they have secured this figure in one or two instances, while business has been done in ordinary London makes, on Beckton terms, at from £11 15s. to £11 17s. 6d. In Liverpool, prices vary from £11 17s. 6d. to £12. In Leith, £12 has been refused for prompt delivery, and £12 2s. 6d. for forward; makers' ideas being £12 2s. 6d. and £12 5s. respectively. Hull is rather quieter than the rest, owing to difficulties in shipment; and the value here is probably not more than £11 15s.

European Gas Company, Limited.—The Directors have decided to recommend the payment of a final dividend of 10s. per share on the fully-paid shares, and 7s. 6d. per share on those on which £7 10s. has been paid, and also a bonus of 2 per cent. on all shares according to the amount paid thereon—making a total dividend for the year of 10 per cent. and a bonus of 2 per cent.

Bulawayo Water-Works Company, Limited.—The ordinary general meeting of this Company was held on Friday. Colonel Lockwood, M.P., presided. In moving the adoption of the report (noticed last week), he stated that the Company had in investments and cash nearly £29,000, and the investments were all in sound securities. They had written off £4113 for depreciation and renewal of plant, £1000 against expenses of the debenture issue, and £2165 the costs to date in the action with the Bulawayo Municipality. The gross profit on the sale of water during the year was £2869, compared with £3437 in 1905, though the number of consumers increased upwards of 5 per cent. No rain fell in Rhodesia for the season 1905 till January of the latter year. During the continuance of the rains in each year, there was a falling off in the quantity of water sold, as consumers fell back on the water stored in their tanks; the sales for 1906 being 10,378,500 gallons, compared with 11,256,700 gallons in 1905. Last autumn the rains set in early, causing a shortage again in the sales for November and December. Owing to a plentiful rainy season, there would be an ample supply of water for the current year, as the reservoirs were quite full at the end of February last. The quality of water was quite satisfactory; and the pumping machinery was kept in thoroughly good order. Lieut.-Col. Jarvis seconded the motion, and it was unanimously adopted.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Trade in all classes of fuel continues firm. Colliery proprietors have now confirmed what has been previously intimated—that no reduction in the prices of house coal would take effect from the 1st of June, as in past years, in the Manchester district. The recent advances in the price of gas coal, cannel, and engine fuel are being maintained at an average increase of 2s. per ton for cannel, and 2s. 6d. per ton for gas coal and boiler fuel. The average quotations, at the pit's mouth, are: Best house coal 14s. 6d. to 15s. 6d., secondary 13s. 6d. to 14s., common 10s. 6d. to 13s., burgy 9s. 8d. to 10s. 4d., best slack 8s. 10d. to 9s. 6d., medium 7s. 10d. to 8s. 6d., lower qualities 7s. 4d. to 7s. 9d. Coal for shipping is 12s. 6d. to 13s. 6d. f.o.b. at Garston. Furnace coke is in good demand. Considerable activity prevails in the coal trade in the Midlands. Earl Fitzwilliam is sinking another shaft on his estate. In South Yorkshire, trade is steady; and best Barnsley coal is fetching from 12s. 6d. to 13s. per ton. Gas coal is also strong. Coal is being exported from Hull and Grimsby in large quantities to all parts of the Continent, and even to Turkey and Bombay. Coal has also been exported to Egypt from Manchester during the last few days.

Northern Coal Trade.

There is a strong demand for coal; and the large output of the northern collieries is well taken up—the exports being very heavy generally. The shipments of gas and steam coals to Germany seem to be especially big at present. For best Northumbrian steams, the prices are steady at from about 14s. 9d. to 15s. per ton f.o.b., second-class steams vary from 14s. 0d. to 14s., and steam smalls are scarce and firm at from about 10s. to 10s. 3d. Work at the collieries is brisk, and will probably be so until the great local holidays towards the end of the month. In the gas coal trade, the demand is very full for this season of the year, more especially for best qualities—the home consumption being maintained through the cold season, and the exports being heavy. For occasional cargoes, Durham gas coals vary from about 12s. 9d. to 14s. 3d. per ton f.o.b., according to quality. As to contracts, it may be said that the settlement of the large local contracts that have been previously named has decided the prices of others, and stiffened the figures in other cases under negotiation. In one instance, however, it is believed that some 50,000 tons of second-class coals have been bought at a price that is expected to leave about 12s. 4d. per ton f.o.b.; but the variation of the freights makes it difficult to give exact figures. In coke, the market is firm; and gas coke is generally steady, with a limited output. Good gas coke is from 15s. to 15s. 6d. per ton f.o.b.

Scotch Coal Trade.

There was fair activity in coal circles during the past week, and a large turnover. Ell is in good request. Splint is plentiful, and the price, if anything, easier. Steam coal is in demand. Small sorts are scarce, this variety going largely abroad. The prices quoted are: Ell 11s. 9d. to 13s. 6d. per ton f.o.b. Glasgow, splint 12s. 3d. to 12s. 6d., and steam 11s. 9d. to 12s. The shipments for the week amounted to 312,715 tons—an increase of 29,365 tons upon the preceding week, and of 53,750 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,492,452 tons—an increase of 193,703 tons upon the corresponding period of 1906.

Alleged Defective Illuminating Power at Llanelly.

At the Llanelly Police Court last Wednesday, the Gas Company were summoned by the Urban District Council for supplying gas of less than the statutory illuminating power of 14 candles on Feb. 19. Mr. George Watkeys, the Surveyor to the Council, stated that he was duly appointed Gas Examiner; and he put in a minute-book recording the appointment on April 4, 1885. Mr. Meager, who appeared for the Company, inspected the book, and then said there was no minute of the appointment, as it was not signed by the Chairman for the time being. An argument thereupon followed as to the validity of the appointment; and Mr. Spowart, for the Council, said he might call some members who were present at the meeting to prove the appointment. The Bench retired, and on returning the Chairman said the Magistrates would like time to consider the point, which was an important one. The case was therefore adjourned for two months.

Opposition to a Village Water Scheme.—An inquiry which was held at Port Isaac, Cornwall, a few days since, relative to an application for a loan for the construction of water-works for the village, was remarkable for the strong opposition which the inhabitants offered to the scheme. The Bodmin Rural District Council, by whom it was put forward, estimated that the cost would be £600; and they asked the Local Government Board's sanction to a loan of this amount. It was stated that Port Isaac is inadequately supplied with water from wells, which, in the opinion of the Medical Officer of Health, are liable to pollution. An offer had been made by Mr. J. Hill, a local landowner, to allow the Council to take water from his estate, and to grant an easement for a main free of cost, as well as to subscribe £30 towards the other expenses. A public meeting was held, with the result that a resolution was carried rejecting the offer, and asserting that there is no need for a water supply. The District Council, however, held that a supply is needed; and though Mr. Hill withdrew his offer, they asked the Local Government Board to approve of the same scheme, and leave the Council to make terms with Mr. Hill. The chief ground of opposition was that there is water enough in the local wells for the supply of the needs of the place, if it is fetched. It was also objected that the proposed scheme is only applicable to a portion of the village. It was said practically all the inhabitants want things to remain as they are.

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Financial Position of the Leigh Gas Undertaking.

In the last number of the "JOURNAL," it was stated that the working of the gas undertaking in the year ending the 31st of March last had resulted in a loss of £584, though the income had increased; and it was added that there was an accumulated deficiency which now amounted to £7054. The annual report of the Gas and Water Engineer (Mr. James Gibson), which was adopted at a meeting of the Gas and Water Committee on Monday evening last week throws considerable light upon the matter. It appears that in the period from 1897 to the present time, by supplying gas free and at net cost for the public lighting, the sum of £17,650 has been given to the rates, in addition to a sum of £4117 transferred in the usual way—making a total of £21,767. The Gas Department has been debited with the whole deficit caused by disposing of these sums; and the accumulated deficiency is now, as previously stated, £7054, beyond which there is a sum of £2152 spent in connection with the Golborne gas opposition. These two amounts make a total of £9206, on which a large sum for interest is paid annually by the Gas Department. It is only fair to the present Engineer to state that practically the whole of this deficiency was incurred prior to his appointment. In 1904, the net profit was £3057; and £200 was expended on benzol plant; leaving £2857 to go to the net revenue account; but this sum was used to pay off a debit balance of £2856 two years later. In the year just closed, the net profit was £964; and it was disposed of as follows: Amount contributed to the public lighting by gas supplied at net cost, £712; written off old meters, £127; and an instalment off the cost of the new carburetted water-gas plant, £125. There was an increase of £497, or 32 per cent., in the district and poor rates last year, which, in Mr. Gibson's opinion, is "out of all reason."

Price of Gas at Bingley.—When the statement of the results of the past year's working of the Bingley undertaking (showing a profit of £1248) was placed before the Urban District Council, Mr. Dawson proposed that the price of gas be reduced 2d. per 1000 cubic feet, the reduction to come into effect next half-year. He contended that the results would justify this concession to the consumers, arguing that the success of the works ought to be participated in by them. Mr. Hartley thought the present moment was not opportune for such a reduction; pointing out that the new coal contracts had not been made, and that there was a probability that the price of coal would be greater than it was last year. The proposition was defeated. A second motion that the question of reducing the price be considered by the Committee after the coal contracts had been placed was carried; but a further proposal that no reduction should be made in price until the whole of the Council's district was supplied with gas at one rate was defeated. The latter motion was intended to refer specially to the Wilsden portion of the district, which, in consequence of being supplied with gas from Bradford, is charged at a higher rate than the district supplied by the Council's own works.

Opposition to the Yarmouth Water Bill.

A Special Meeting of the Yarmouth Town Council was held recently to consider the advisability of continuing the opposition to the Water Company's Bill, which, as reported in the "JOURNAL" for May 7 (p. 390), has already passed the Lords' Committee. The Corporation had previously met as the General Purposes Committee, when, by 26 votes to 8, it was resolved, on the recommendation of the Water Works Sub-Committee, to oppose the Bill in the House of Commons, after an amendment that the Company be first approached had been rejected. In moving the confirmation of the report of the Committee, Mr. H. Chamberlin said that personally he was sorry, but he felt that the Council were bound to continue their opposition. To drop it now would be inconsistent with the report of the Local Government Board. Much as they respected the Directors of the Water Company, there was no alternative, having commenced the opposition, but to carry it further. The Deputy-Mayor, who seconded, said that at first he was somewhat doubtful as to the right course to pursue; but from what he had heard during the progress of the Bill, and having read the evidence, his opinion was confirmed that it was the duty of the Council to continue the opposition. After the report of the Local Government Board, they would be sadly neglectful of their duty if they did not. They believed the Directors were actuated by the highest motives; but the experts who advised the Corporation were quite as eminent as those from whom the Water Company had received their opinions. The Council were custodians of the public purse; and it was a matter of regret that they were compelled to spend so much, as it might seem almost wastefully; but as guardians of the public health they could do nothing less, and it would be false to themselves and their constituents if they did not put the public health even in front of the ratepayers' purse. At the conclusion of a long discussion, it was decided, by 24 votes to 3, to continue the opposition.

A Gas Supply for Yoxford.—The Clerk to the East Suffolk County Council (Mr. A. T. Cobbold), having been instructed to obtain information as to the powers and stability of the Saxmundham Gas Company, Limited, said he understood the supplying of gas to Yoxford was a matter of urgency. The Company were not working under a Provisional Order; and of the capital of £5000, £4200 was called up. Other inquiries he had made were of a satisfactory nature. He suggested that a way-leave rent of £1 a mile should be charged to the Company for the use of the roads. Mr. Bales asked whether the mains would not be rated to the county rate. If that were so, they would be paying their share. The Clerk said he could not advise the Council to forego rent. Mr. Moore suggested that the rental proposed was a heavy one, and was a great deal for a small Company to pay. He thought half the sum would be sufficient. He moved a resolution to the effect that it should be 10s. per mile. Mr. Bales seconded the amendment; but it was negatived, and the proposal of a rental of £1 a mile was agreed to.

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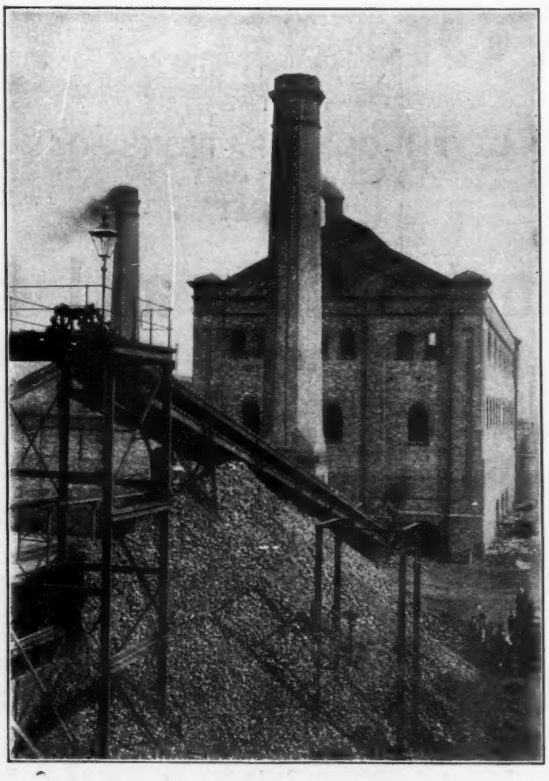

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Ampthill (Beds) Water Supply.—The Ampthill Rural District Council have adopted a water-supply scheme, at an estimated cost of £12,500, to supply Woburn, Woburn Sands, and Aspley Guise. The water will be derived from a well at Birchmoor Farm, on the property of the Duke of Bedford; and it is proposed to construct the reservoir on Bow Brickhill Heath, at an elevation which will allow of the whole district being supplied by gravitation.

Staffordshire Potteries Water-Works Company.—The report presented at the 61st annual meeting of this Company stated that the water revenue for the past year was £59,519, or an increase of £1934 when compared with the preceding twelve months. The profit on revenue acccount was £30,465; and the Directors recommended dividends at the rates of 9½ per cent. on the consolidated ordinary stock, free of income-tax, and 7 per cent., less income-tax, on the consolidated new ordinary stock. The report was adopted; and at a subsequent extraordinary meeting, the Directors were authorized to raise £12,000 by the issue of consolidated new ordinary stock, and £4000 by the issue of perpetual 3½ per cent. debenture stock.

Irregular Ordering of Coals at Haverfordwest.—Haverfordwest (to judge from proceedings in the Town Council) has been much perturbed over the ordering of a quantity of coal outside the ordinary gas-works contract. Mr. White, the Chairman of the Committee, on his own responsibility gave the order for the coal; stating that Mr. J. Gibbon, the Gas Manager, had told him he required more coal. This, however, the Manager denied, saying that he had plenty in stock. The charge for this extra coal is 2s. 6d. per ton beyond the contract price; and besides this it is said to be of a less satisfactory quality for gas-making purposes. About 47 tons have been delivered; and 20 tons more are expected. The Council decided to repudiate liability in respect of the quantity still undelivered; and Mr. White undertook that he would not order anything again until he had called a meeting of the Committee.

Metropolitan Water Board's Charges.—At the meeting of the Islington Borough Council last Friday, the Mayor (Alderman Elliott) said that, the preamble of the Metropolitan Water Board's Charges Bill having been practically proved, it might be of interest to some of the members to know that what he stated some months ago with respect to the 5 per cent. had been proved up to the hilt, and objections had come in from the higher-rated people. One petition was presented by the Chamber of Commerce, which gave the following figures: Under £30, some 271,000 odd consumers were not affected, and 402,000 odd saved on the average 5½d. each; from £31 to £50, 173,000 odd saved 8s. 6d. each; from £51 to £100, some 7300 odd saved 10s. 11d. each; from £100 to £200, 25,800 odd saved 6s. 1d. each; above £201 to £300, there would be a charge of £2 4s. 11d. more; from £301 to £1000, £5 2s. 6d. more; and for those rated at over £1000 there would be an increased charge of £33 18s. 2d. He thought this showed that under the Bill the Board got practically the whole of their money from the rich, as he had said months ago. The figures were not those of the Board, but of their opponents.

Burnley Gas and Water Supply.—The Burnley Corporation Gas Committee have made a profit on the past year's operations of £11,788, the whole of which will go in relief of the rates. The Water Committee have decided upon the construction of a new reservoir a short distance from the town. It is to be larger than any of the existing reservoirs, and is to have a holding capacity of 325 million gallons. The estimated cost is £164,000.

Checking Waste of Water at Croydon.—The Croydon Borough Council recently issued instructions to their water inspectors that they were to supply washers free of cost to all leaky taps. The waste of water which this system has prevented may be easily estimated when the fact is known that in an inspection of 2144 houses, 252 taps were supplied with washers. The inspectors carry with them on their daily rounds all implements necessary for doing the work without delay.

Purification of the Thames.—Considering the extent to which the River Thames is drawn upon to supply the Metropolis with water, it is satisfactory to learn, from the annual report of the Conservators lately issued, that during the year ending Dec. 31 last sewage from nine places, representing a population of upwards of 22,000 persons, was diverted from the river and its tributaries. As the result of the Conservators' action in the past, works for the purification of the drainage are now in operation in nearly all the towns and populous centres in the watershed. Particular attention was paid to these works last year; and to test their efficiency the effluents were frequently analyzed.

Lighting of Castle Donington.—At an extraordinary meeting of the Castle Donington Council, held to consider the question of public lighting, it was stated that the terms offered by the Gas Company were in advance of those of last year; and the Chairman (Mr. L. Stevenson) said it was unfortunate that, when the Company had only just reduced the price to ordinary consumers, they should ask the ratepayers for an increase for public lighting. The Council did not ask for preferential treatment; but the public lighting of the town had been latterly so unsatisfactory that some alteration was now absolutely necessary. It was agreed that a Special Committee should be appointed to meet the Directors of the Company.

Sales of Shares.—At a public auction recently held in the Royal Hotel Hall, Coatbridge, by Mr. John Gardner (Messrs. Gardner and Wallace), 30 lots of ten £10 shares in the Coatbridge Gas Company realized the following prices per share: 23 lots, £16 15s.; five lots, £17; and two lots £17 10s.—the average price being £16 16s. 10d. The present dividend on these shares, under the sliding-scale, is 8·2 per cent. per annum. Messrs. Hollis and Webb sold last Tuesday 40 original and 20 additional £10 shares (10 and 7 per cent.) in the Whitby Gas Company for £870 7s. 6d. Last Wednesday, Messrs. Wyatt and Sons sold £3000 of "C" stock of the Chichester Gas Company; being part of the additional capital authorized to be raised by the Company's Order of last year, to meet the recent outlay on the works and mains, to which reference has already been made in the "JOURNAL." Lots of £106 each fetched from £127 to £131; those of £50, £63 to £63 10s.; and £25 lots, £31 10s. to £32 apiece.

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The East Ardsley Gas Company have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for lining one of their existing leaky gasholder tanks with a new steel tank, and extending the guide-framing; also for adding an additional lift to the present holder.

The New Mills Urban District Council have completed the purchase of the water-works undertaking from the representatives of the late Mr. F. J. Sumner, by signing a cheque for £11,000—the purchase-money, in addition to legal charges. The Council are now negotiating with the Stockport Corporation for their water-works at Newtown, in the Council's district.

The Oswaldtwistle Urban District Council have applied to the Local Government Board for sanction to borrow £1000 for their gas undertaking. The Surveyor (Mr. R. N. Hunter) explained to the Inspector who held the inquiry that the gas consumption was increasing rapidly, and it was necessary to make some alterations to the existing storage accommodation.

We have received from the Bryan Donkin Company, Limited, of Chesterfield, the edition for 1907 of their valve catalogue, which, besides bringing up to date all the particulars of their various types of valves, includes many new features. In the appendix will be found short descriptions, with illustrations, of some of their other specialties, such as exhausting plants, tar and water pumps, &c.

The Newcastle City Lighting Committee report that eighty lamps fitted with automatic lighting appliances are working highly satisfactorily. They are, however, of opinion that it will be better to wait a little longer, in order to make further tests, before increasing the number of lamps to be lighted by this means. It is stated that this new system of lighting and extinguishing lamps, when ultimately adopted throughout the city, will result in a saving to the community of over £2000 a year. It will displace nearly ninety lamplighters, but will give employment to thirty lamp cleaners, and eight inspectors.

Mr. Duncan Sinclair, a Director of the Gilbert Little Company, Limited, who is an engineer and metallurgist of considerable repute, devoted some years, often with disheartening results, to experimenting with and reconstructing a chain-making machine, which would draw in a steel bar automatically at one end, and deliver it at the other assembled link-belt absolutely accurate in pitch for conveyors, elevators, and chain-drives. He eventually accomplished the feat, and the above-named Company acquired the exclusive rights of the chain for conveyors, elevators, and the transmission of power. All sizes of this machine-made tempered steel pitch chain have been put to work during the last six months for the most varied and difficult kinds of driving, with, we are informed, most satisfactory results. Four chain-machines are already at work, each capable of making half-a-dozen sizes of chain of varying strengths and pitches, at the rate of 200 feet each per hour; and a larger machine is to be placed in position to make six very strong sizes for the largest types of elevators and conveyors. A ton of steel bar makes a ton of chain of any size, which may be regarded as a marvellous feat in mechanics.

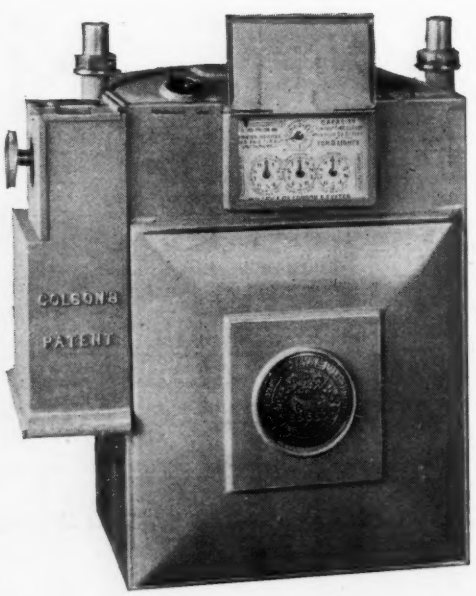
The South-West Suburban Water Company have just declared a dividend at the rate of 5½ per cent. per annum on the original shares.

The Cannon Iron Foundries, Limited, of Bilston, have secured the sole supply of gas cookers and meters to the Somerton Gas Company; and, under the auspices of the Company, an exhibition of gas-stoves, &c., has just been held, when cookery lectures were delivered by Miss Lewis, who gave practical demonstrations with satisfactory results.

The Chemical Engineering Company and Wilton's Patent Furnace Company have recently received contracts for two complete sulphate of ammonia plants for the Compagnie L'Union des Gaz, to the plans of their Engineer, Mr. A. F. Phillips; and sulphate plants for the Thurso, Barrhead, and Castletown Gas-Works. In addition to these, the Company have six large sulphate plants in hand for chemical works and collieries, and one large tar plant in duplicate.

The Gas Committee of the Nelson Corporation are borrowing £22,000 for the following purposes: £4800 for gas-cookers, £7720 for meters, £8100 for new mains, and £1400 for a driving main. The expenditure is rendered necessary in consequence of the large expansion of the borough; and it is estimated that if the town continues to grow as it has done of late, that the money will have been spent in five years. Last year the gas consumption showed an increase of almost 10 per cent., and a net profit of £4320 was returned.

The tenth annual meeting of Meters Limited, was held at Manchester last week, when the Directors' report—referred to in the "JOURNAL" for the 21st ult., p. 545—was adopted, and a final dividend of 3½ per cent. was declared on the ordinary shares, making 6 per cent. for the year. Alderman John Miles, who presided, said that while they could congratulate themselves upon the work of the Company for the past ten years, they were to-day in the unfortunate position of having a somewhat diminished profit to record. The influences that accounted for this were mainly the high prices for raw materials used in the manufacture of articles sold by the Company. In the first year of the Company's existence, the price of copper and of ingot tin—of which they used large quantities—was £55 and £81 per ton respectively. To-day the price for these commodities ranged at about £112 and £194 per ton. Other materials had all more or less increased in price; and these advances, unfortunately, were not accompanied by a corresponding increase in the prices obtained for the articles the Company sold. The rise in the cost of raw material was much larger than the decrease in the net profit. As to any suggestion of getting an increased price for meters, he might say that at the present time some manufacturers were adopting a suicidal policy in selling goods at figures that yielded no profit, and in some cases actually made a loss. He hoped the Company would never work on such lines; but as these low prices prevailed, the Company had to act accordingly. Apart from the question of price, the Company prided themselves on the quality of their meters. The Directors believed that the topmost prices for copper and tin had been reached, and that shortly they would have the benefit of a change; and they hoped that at the next annual meeting they would have a much more satisfactory statement to present.



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